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CONTENTS

FISHERIES AND NAVAL ARCHITECTURE 167

FAO PLANS FOR A WORLD SURVEY OF LIVING AQUATIC RESOURCES 197

FAO/ETAP INTERNATIONAL TRAINING CENTERS IN FISHERIES 202

CONFERENCES AND MEETINGS 221

- International Whaling Commission 221
- International Seaweed Symposium 223

FISHERIES DIVISION ACTIVITIES 224

- Program of Work - Economics and Statistics Branch 224
- Expanded Technical Assistance Program 229

INDEX 235

Editor: D. B. Finn

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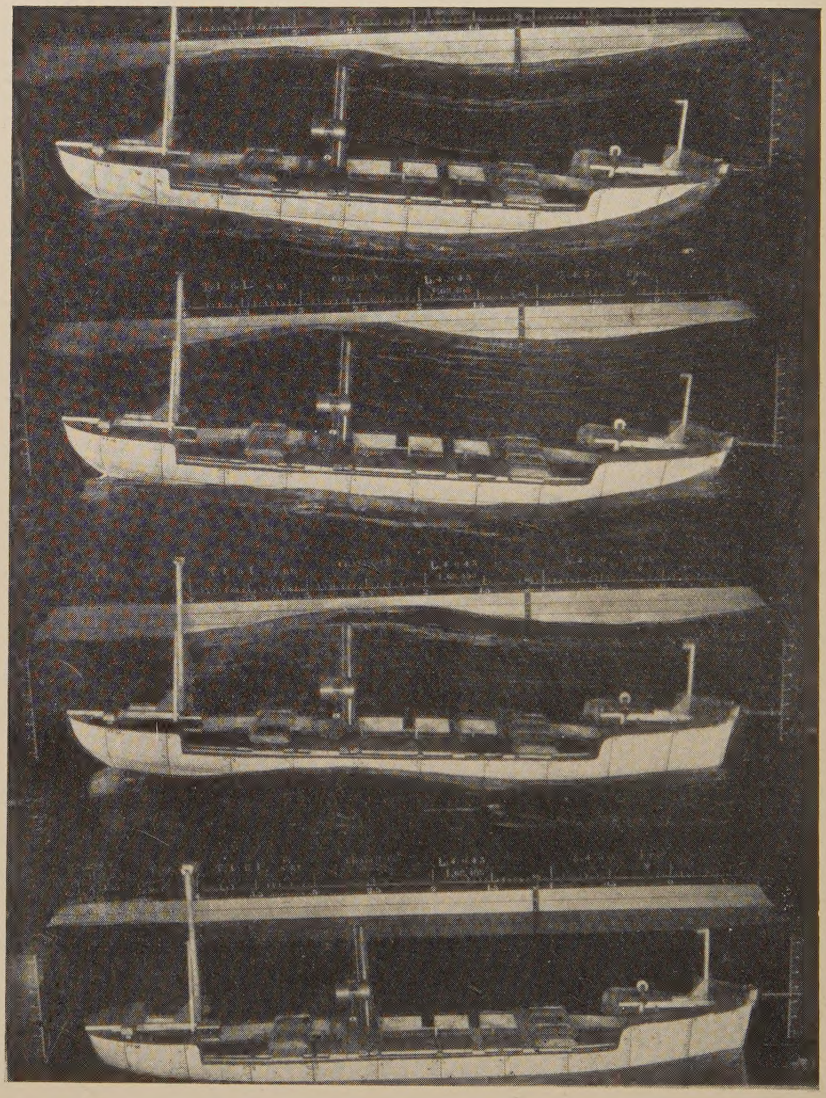

Figure 1. Model test with an 88.5 ft. (27 m.) trawler in waves in Le bassin d'essais des carènes in Paris. The lower photograph shows the model at rest in smooth water ; the three at the top show various degrees of pitching. Such tests are useful for determining the decrease in speed due to head seas and the correct shape of the deck line.

FISHERIES AND NAVAL ARCHITECTURE [1]

Biology, oceanography, economics and processing technology are relatively new sciences in fisheries, but the art of building boats is very old — as old as fisheries itself. Boats and ships have been built by memory, experience and by rule of thumb for thousands of years and it is only during the last two hundred years or so that it has been possible to predict, before a boat was launched, how it would float, whether it would be stable, etc. It was the development of "theoretical naval architecture" that made it possible to calculate volumes, centers of buoyancy and stability. Previously boats were entirely built on a trial and error basis with a great deal of art added to it.

No large merchant vessel or pleasure yacht is built today without architect's plans. But large fishing boats costing hundreds of thousands of dollars each are still being built with few plans, if any, and the builder is often surprised that the boat does not float on the water line he thought it would. Such a builder follows the design of boats built by his father, or some other master shipwright, without departing too much from the principal dimensions, so he believes they must be all right and it comes as a surprise to him if everything is not more or less as he expected. He had perhaps not been able to calculate the effect of changes in weights of equipment or machinery or in the general arrangement. Unfortunately, he has little or no knowledge of the theory of naval architecture and usually he is proud to announce his lack of confidence in theories.

Boat building and ship construction was at one time definitely an art based on a considerable amount of experience. Generations had accumulated a wealth of rule of thumb knowledge, and as long as builders did not depart too far in size and type, the results were acceptable. In any case, builders were exceedingly afraid of any great change as they could not judge the effect. And this is the key to the main difference between naval architecture in the modern sense of the word and practical boat building; the naval architect can predict beforehand the performance of a project. Today, naval architecture is a blend of art and science.

Because theoretical naval architecture is so comparatively new it does not yet allow an absolute scientific approach to all problems. Speed, or rather the estimation of power to propel a vessel at a required speed, has still to be calculated on purely empiric experience based on tests with models. Many efforts have been made, especially during the last decades, to calculate the resistance of a ship mathematically directly from the drawings, but the metbod is not yet fully developed and even when it is, it would probably take so much time that it would not be used in practice.

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[1] By Jan-Olof Traung, Chief, Fishing Boat Section, FAO, Rome, Italy.

I. Models

Formerly, and still quite often today in fishing boat construction, the boat builder makes a scale model of his planned ship before he starts actual construction. He uses this model to get an impression of the shape of his ship and he may cut it in sections so as to arrive at a lines drawing. The technique of using models in predicting ships' speeds has naturally intrigued many workers and it was only about one hundred years ago that an Englishman, Froude, succeeded in determining how a test with a model should be evaluated so that it represented the conditions of a full-scale ship. Today, there are a considerable number of ship-testing tanks in many countries and tens of thousands of models of ships have been tested, while more instruments of greater accuracy have been developed, and Froude's methods of predicting resistance with the help of models have been refined.

From the results of these model tests, the naval architect is today able to predict, relatively precisely, even if on empiric grounds, the performance of the boats he designs, and it is possible for him to see whether the proposed engine power is sufficient or not. But the majority of the world's fishing boat builders, who make good use of models to get the impression of hull shape and to lay down the body plan to make the frames, are still very skeptic of the possibilities of predicting a ship's performance with the aid of model tests. They are ready to accept the validity of such tests for yachts and large vessels but they believe that a boat used for fishing is different.

In Froude's old tank in Torquay the first model tests were purely resistance tests where the model was towed and not self-propelled. Modern ship-testing tanks can carry out a number of detailed experiments with self-propelled models and with models in artificially made waves to determine sea behavior and maneuvering qualities, etc. *Figure 1* shows a typical model test. Although it may seem superfluous to many naval architects, it must again be stated that a model test is nothing but one to find out the performance of a certain design. Too many bad designs have been passed because the model happened to have been tested and the designer, the shipyard and the owner thought that this fact in itself was a guarantee that the design was good. Making a test is, in a way, like taking the " temperature " of the model. Any naval architect or boat builder who says he has no use for modeltests, is like a doctor who says he has no use for a thermometer.

II. The Fisheries Naval Architect

The design of the hull shape is only one of the tasks of a naval architect. Actually, the time taken to design the hull shape when making a complete design is only a fraction of the total time involved. Many naval architects get no opportunity whatsoever to work on such problems. If employed by a large shipyard, they might be placed in the hull design department dealing only with the structure of the ship, or they might work on problems of accommodation or

marine engineering all their lives. There is in naval architecture the same specialization as in other fields of engineering and, in the design staff of a large shipyard, only a few people deal with the hull shape as such, which gives the impression that the subject is not too important. In a large shipyard the specialists are undoubtedly very important, but in fisheries the " generalists " are the more important. Such a naval architect must not lose sight of the over-all problems and he must especially have a keen appreciation of economics. In this respect it is rather fortunate that many naval architects working in fisheries today have acquired experience in small private shipyards where they were forced to do a great deal of " economic " thinking.

Another requirement of a naval architect working in fisheries is that he must be a psychologist. He must be able to sell his designs and to show the operators that they will make a higher profit if they follow his advice. It is also probably as important for him to convince the fishermen that the boat of his design will be better from their point of view, that it will have an easier motion, that there will be fewer steps for them to climb and that the fishing platform will be protected from the weather, and so on. The architect can make benches, bunks and chairs more comfortable at no more cost and, with some thought and planning, he can provide greater floor space and inside volume than can be provided in a rough design. The skipper-owner does not normally understand how to read blueprints, and he would be unable to understand the effect of a change in metacentric height. It is up to the naval architect to demonstrate his design by making attractive perspective drawings to show the accommodation and the type of the boat, or to use models and, in personal conversation with the owner, convince him of the merits of the new designs.

Again, to get his designs sold, to allow himself as much scope as possible and to avoid delays, the naval architect should develop existing types of boats rather than prepare revolutionary designs. It is fairly easy to improve a design without changing the type of the vessel as such. Improvements made in the hull shape below water, in the method of construction and in the arrangement of crew quarters, improvement of the fish room, etc., do not have to change the familiar look of the vessel. If one fishing community is accustomed to boats with extreme sheer lines, the naval architect might be quite correct in stating that with a straight line from stem to stern the boat would gain a considerable volume amidships, but he would spoil the look of the vessel and discourage the fishermen from using it.

Even if naval architects have so far contributed little to the world's fish catch, their contribution to fisheries is not altogether new. They have had quite a hand in the development of the large long distance trawlers in both Europe and the United States of America. The modern European long distance trawlers are, without doubt, very much developed and many are on the same technical level as larger ships. But so far as smaller boats are concerned — under 100 ft. (30.5 m.) — the role of the naval architect has been insignificant. This is true of practically every country in the world.

III. Naval Architects Need to go Fishing

One reason why naval architects have had so little to do with these ships, in spite of the fact that the unit cost might be as high as U.S.$ 100,000, is that they have failed to acquire a thorough knowledge of the different types of fishing gear used in fishing boats. When a fisherman finds that a naval architect hardly knows the difference between trawling and purse seining, he naturally is doubtful of the architect's ability to design a satisfactory ship. If a naval architect wants to design fishing boats he should acquire a very thorough knowledge of various types of gear and of the conditions of the fishing industry in general. This knowledge cannot be acquired merely by reading books, partly because there are so few books available on the subject, but it must come from actual experience gained by taking part in fishing operations. Too often the fishing boat designer remains in the office waiting for the fisherman to come and see him. Instead he should take the trouble to find out all the fisherman's problems. Frequently, when the fisherman does not approve of some design ideas, the architect simply accuses him of conservatism.

If a naval architect develops an interest in the working of different kinds of fishing gear, he will soon find that he can himself contribute valuable knowledge to gear technology. Until recently, very little comparative trawling has been done and many answers remain to be found to problems of behavior of trawls. The naval architect could supplement the gear technologist here and assist him considerably in speed and power estimates, the estimation of actual speed of water inside a trawl net and the proper design of trawl floats and trawl doors. Similarly, close co-operation between the naval architect and the gear technologist could probably improve the technique of handling purse seines and other expensive gear.

In his hard, strenuous work, exposed to the weather, the fisherman naturally tries to find improvements for his boat and, when ordering a new one, he wants to avoid some of the drawbacks of the old boat. But fishermen, like all other people, tend to become blind to defects or possibilities of improvement because of familiarity with their ships and do not see possibilities for improvements which are apparent to the onlooker. The naval architect who goes to sea with the fisherman would probably, by making "time and motion" studies of the handling of fishing gear and operation of the boat, be able to propose considerable improvements.

In some fields of fisheries, experimentation and exploration is not only permitted, but is the object of the work. The biologist and the gear technologist can and should make experiments to find out methods of improvement. They can even take a gamble when there is a chance to make a short cut instead of making a strictly comparative test. But a naval architect must ask for evidence before he introduces any changes in his designs because much greater amounts of money are invested in the boats than in gear. Gear is expendable, but boats are assets. Their cost is borne by individuals and not by

governments or institutions which normally sponsor biological or gear technological research. Even if a technologist advises a fisherman to buy fishing gear which, in the final operation, does not work, the harm done is not of the same serious nature as when a fisherman gets an unsuitable or uneconomic ship.

IV. Approach to the Work

A fishing boat designer is, therefore, a kind of a specialist in naval architecture because he has to give so much attention to the functional requirements of a fishing boat. It is unfortunate, therefore, that there is hardly any fisheries instruction in regular courses in naval architecture and there are very few consultant naval architects under whom a young man, newly graduated in naval architecture and fascinated by fisheries, can get the necessary experience in fishing boat design. He is restricted to reading the few books available, searching literature, going fishing, and obtaining the necessary experience in building fishing boats by working in shipyards specializing in this type of work.

A fisheries naval architect will be mainly engaged in the following types of work :

1. The design of a ship of the type, and with the main dimensions, specified by the owner. In a developed fishery much experience has been gained regarding the economic size of fishing boats. Regulations in regard to financial aid, construction, limits of validity of skippers' certificates, restrictions of depth in harbors etc., might limit the main dimensions to a certain size and it is the duty of the naval architect to get as much out of these possibilities as he can. The naval architect working under these conditions, however, is very liable to act as a draftsman and just simply designs what he thinks pleases the fishermen without studying the whole issue to improve the efficiency of the design.

2. The design of a boat, but at the same time modifying the main dimensions suggested by the owner, and the arrangement for :

   (*a*) technical reasons — to increase the speed without increasing fuel consumption ; to decrease the construction cost in placing the boat in another class, making it possible to use lighter scantlings ; or to modify the dimensions so as to get the registered tonnage of the boat below a limit above which harbor dues would increase out of proportion ; or

   (*b*) straight economic reasons, because a suggested dimension would produce a fish hold which could not be utilized or because the boat is over-powered, etc.

3. The determination of the correct size and type of boat to be used in a new fishery, which will involve a study of the available boats, catches, economic conditions in the locality and will necessitate consultations with biologists and gear technologists to find out an estimated catch per time unit. This type of work might involve the design of boats of different sizes to determine the performance and running expenses for each type and then to make a number of cross curves so as to find out the optimum size of the boat. Naturally, it is necessary for the architect to study how to make best use of the boat-building facilities in the region.

Each of these three types of work has its given place, and each requires a considerable amount of different labor. Some naval architects, during their work in one area, have developed certain "standard" designs which have proved very successful in that area.

When being consulted for a new area, they sometimes recommend the use of such "standard" designs without considering the local type of fishing and the local circumstances. Such a recommendation can be very dangerous. When a naval architect is called in to a region where no such work has been carried out before, there is often some wishful thinking that, after a short visit, he might be able to recommend a number of designs which will have immediate and significant effect on the fisheries. If the architect does not make a careful study he will not be in a position to give well-founded advice, and if he gives advice just because he feels he must, it might cause more harm than good.

But it might also happen, if such a naval architect goes to a new area, that he will see that the present boats are as good as they can be, even if the operators are of another opinion. The writer, who is rather critical about some fishing boats from his own home country (Sweden), has found local fishing boats in some other places, such as Newfoundland, to be of very good design. It seems that Swedish fishing boats were considerably better, especially from the resistance point of view, before engines were introduced. It is generally true that as long as fishermen were sailing or rowing they and the boatbuilders had a much greater sense of good hull shape than they now have in the case of mechanized craft. It is as if the engines had taken away the feeling for lines in some communities, and when a boat is slow they no longer blame the hull, but think it is the fault of the engine, the propeller, fouling, and so on.

Fishing boats have to be adapted to local conditions. This does not mean that they should be developed without study of the boats in other countries. The recent FAO International Fishing Boat Congress [2] clearly showed that the same problem has been solved in different ways in various countries and that much could be gained by introducing good ideas from other boats. This does not necessarily mean that the character or type of the boat has to be changed.

[2] See *FAO Fisheries Bulletin*, VI (6), 243-46; VII (1), 27-30; VIII (3) 153-54.

V. Boats will Always be Improved

The need for a boat to be adapted to local conditions must not be used as an excuse for the opinion that fishing boats cannot be improved. In Sweden, it was said 40, 30, 20 and 10 years ago that the boats were adapted to local circumstances and they could not be improved, but yet they have changed. A study of boats built at ten-year intervals reveals great differences. In Sweden, the off-shore fishing fleet today is about five times larger per unit, on an average, than it was 40 years ago. The engines are about eight times stronger and the crews are accommodated in the stern with its easier motions, rather than in the fo'c's'le, as before. Even as late as five years ago this was said to be completely impossible. Boats will certainly be further developed during the coming ten years. How fast the development will be depends to a large extent on whether naval architects work on the problems. If they do, they will speed up development. It would be easy to show, for example, how fuel consumption in the Swedish boats could be decreased by 30% without the boats losing any speed in calm weather, and having less speed reduction than now in bad weather. Yet most fisheries people still believe that the boats are so adapted to local circumstances today that no further improvements are possible. This is about equal to stating that present cars will never be changed.

Also, when told that the fuel consumption could be decreased considerably or the speed could be increased, fishermen sometimes say that the fuel cost does not matter and they rather prefer the type of boats they have and are used to. The fuel cost of fishing boats is often 30% of the total expense of such a boat and when, recently, the coal prices in the United Kingdom were increased by 20%, the whole industry was turned upside down saying that fishing would be a complete loss. Eventually the authorities were forced to increase the subsidy paid to the trawler owners in order to compensate them for the increase in coal prices. Such a 20% increase in the cost of the coal can upset the whole economy and similarly great changes in the way of better economy would be the result if the cost for fuel could be decreased by 30% simply by modifying the hull shape.

VI. The Dilemma of Speed

The greatest handicap of a naval architect in trying to design fishing boats is the scarcity of reliable information about their performance on actual duty. It is easy to obtain information about the general dimensions, the registered tonnage, the power of the main engine, and the general design and arrangement of the boat. But as soon as one wants to know the speed a particular boat can make under varying conditions of load and wind, and the engine power and fuel consumption corresponding to this, one immediately finds that little data exist. Fishermen do not keep careful log books similar to those found in large merchant vessels. When a fisherman is asked about the speed of his ship, he might state a speed as much as 2 knots

faster than the boat is actually capable of making. The writer has had the opportunity of interviewing fishermen in quite a few countries and the information relating to speed is not at all dependable. He has carried out a few speed trials, under controlled conditions, and has found that the skipper always thought his boat was faster than the trial showed.

Data from trials are very hard to get. Indeed, very few real speed trials have been made with any fishing boat. FAO, which has been able to collect quite a lot of data from model tests, has little trial data on stability, etc., in its files.

Simpson (1955), one of the foremost American fishing boat architects, humorously describes what happened at a trial of a U.S. $250,000 115-ft. (35 m.) trawler. FAO had sponsored extensive model tests with this design so that he was in possession of a report with considerable basic data to compare with his trial data. The designer could get no help to determine the actual draft of the boat so he had to guess the trial displacement. At the time of departure for the trial it was evident that the crew and the guests had brought along their entire families. After a couple of monotonous hours spent in adjusting the compass, the vessel made a full powered run between two buoys, an estimated distance of 7.3 miles (one buoy was said to have been a half mile out of position). A shorter and more accurate course was vetoed by the owner/captain. On the return trip the mate, without consulting anyone, decided to take the turns out of his new trawl wires, so the boat towed two 400 fathom lengths of $^{7}/_{8}$ inch wire. The position of the rack of the fuel pump of the engine indicated an output of 680 h.p. Exhaust temperature indicated 520 h.p. Then the compass adjuster had an appointment and a dozen or so children were more than bored, so the boat returned to the dock where everyone except the marine engineer from the engine makers and the designer agreed that it had been a wonderful day.

Mr. Simpson's story shows what happens at almost every fishing boat trial and it proves how difficult it is for designers to know what speeds fishing boats are actually making. The situation would be all right if it were only a matter of keeping the fisherman happy in his belief that the boat made those 2 extra knots. But the point is that when a naval architect approaches the problem of designing a boat, he must know the speed to find out the speed/length ratio.

The speed/length ratio, which is the relation between the speed and the square root of the length of waterline of the boat, is the design key for the naval architect. A boat with a speed/length ratio of $^{*}V/\sqrt{L} = 1$ should have a hull shape different from that of a boat with a speed/length ratio of $V/\sqrt{L} = 1.4$. If a designer, from interviews with fishermen, is given to believe that the fishing boats in question normally sail at a speed/length ratio of 1.4 when the ratio is actually only 1 he

* English system where "V" is speed in knots and "L" is length of waterline in feet. Also widely used is the non-dimensional system $\frac{v}{\sqrt{g\,L}}$ where "v" is speed in m./sec. "g" the acceleration due to gravity and "L" the length of waterline in meters.

will design a boat which might require considerably more fuel during average operating conditions than would be the case if he had had the right particulars. Then, even if a boat can achieve a certain speed at the trial, maybe with the engine overloaded, one must not lose sight of the fact that the trial speed should not be the speed for which a boat is designed. When the boat has been water-soaked, has more equipment added, and is filled with ice and fish, it will weigh more and make less speed. There is also the point that the owner might not want to take the last horse power out of his engines during daily operations and this further reduces speed. Furthermore, the sea is seldom calm, so the average speed is normally considerably lower than the trial speed. It is this average sea speed which should determine the design and this will result in a speed length ratio which will be quite different from the one established after uncritically interviewing fishermen.

There is not much that the naval architect can do to convince a fisherman, who has just been delivered a U.S. $250,000 boat, that he should spend a day in making trials, when he is eager to go fishing and start making some money to pay for the boat. The fisherman cannot see how a speed trial could improve his boat. A fishing boat architect must face the fact that the required standardization trials over a measured mile are not likely to be made and he must make use of other devices to measure speed, such as a resistance log, with the help of which he can determine the speed during trips to and from fishing grounds without having the boat run on a measured distance. The difficulty in establishing reliable speed data further stresses the point that naval architects must go to sea with fishing boats. Then they can, during actual fishing operations, make their observations with suitable logs or with the help of position instruments such as Decca (Loran). The difficulty is that the fisherman will not pay the architect for such services, which would require him to be away from his office for weeks. It would be welcome, therefore, if professors of naval architecture could encourage their students to take trips with fishing vessels to make such recordings, or if government fisheries agencies could sponsor the work. *Figure 2* gives curves for trials in smooth water and average speeds of fishing vessels. These curves are based on very few data. If, as suggested, students of naval architecture could collect more data, this diagram could be adjusted.

VII. Hull Shape

Fishing boats vary considerably in type and size from country to country due to fishing methods, distances to fishing grounds, local traditions, etc. The shape of fishing boat hulls naturally varies, as, for instance, a U.S. Pacific coast purse seiner having its main weights, such as engine and deck house, forward, and a Danish seiner, having those aft, but the differences are not as great as the general arrangements suggest.

Experience gained in one country in the design of hull shape can easily be used in other countries, and therefore, the naval architect is

especially encouraged to study what is being done internationally in this field.

When a layman looks at a boat he is naturally interested in its function, arrangement, accommodation, etc. He also tries to appreciate its "beauty." Now, beauty is not something upon which everybody agrees and one layman, thinking that one type of line is beautiful, will select some boats, while another man, thinking another type of line is beautiful, will select others. This is naturally a most unreliable

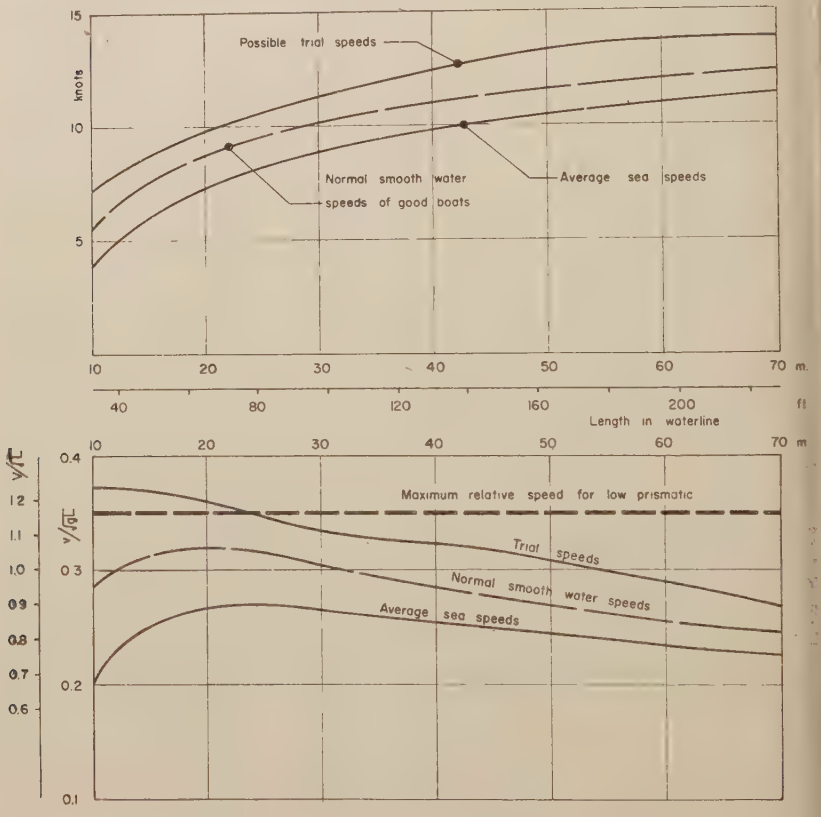


Figure 2. The top diagram shows curves with the maximum possible trial speeds of good boats having the dimensions and engine power given in *Figure 3.* The medium curve indicates speeds obtained in smooth water by modern boats in use today. The lower curve is an estimation of the average sea speed at which fishing boats sail. The lower diagram shows the same information expressed in curves for non-dimensional speed/length ratios. The limiting line for speed/length ratio 1.15 (0.35) indicates that all fishing boats today sail at speeds where a low prismatic co-efficient is profitable.

method of judging any type of boat. Naval architects think in terms of ratios, relations and co-efficients and when they see a boat on land they convert its proportions to such ratios to determine its quality.

The speed/length ratio is the most important one. It determines the type of hull shape. It indicates also that the longer boat will obtain a higher speed in knots more easily than the smaller one. *Figure 2* also shows clearly how the speed in knots increases in boats varying from 33 to 230 ft. (10 to 70 m.), but shows how the speed/length ratio decreases.

Figure 3 shows typical data of beam, displacement and engine power for fishing boats from 33 ft. to 230 ft. The curves are based on data from a number of selected boats and the curves are only given to show the trend. They should not be used even for preliminary calculations. They can, however, be helpful in a fast check to see whether some proposed measures of beam, displacement and engine power are nearly normal or not.

Figure 3 also shows the power necessary at certain speeds when the hull shape is extremely good (solid lines) and when of average quality (lines in dashes). As a matter of fact the diagram is designed on the basis of the results from a great number of model tests with fishing boats. It shows that a boat with a main engine of 200 h. p. will drive boats of from 65.6 to 105 ft. (20 to 32 m.) long at 9 knots in spite of the fact that the 105-ft. boat will have a displacement of 320 tons as compared with the 110 tons of the 65.6-ft. boat. The beam of the larger boat will be 24.2 ft. (7.4 m.) instead of the 19.7 ft. (6 m.) for the smaller boat. This proves that the additional length of the larger boat decreases the required horse power per tons of hull weight so that it offsets the fact that the large hull is about three times heavier than that of the smaller boat. It shows how important it is to make boats as long as possible. The same diagram shows also that with an engine power of 400 h.p. a 69-ft. (21 m.) boat will make 11 knots. The same speed can also be obtained with the same engine power by a 148-ft. (45 m.) boat having 675 tons displacement, as compared with 125 tons for the small boat. A 69-ft. (21 m.) boat will require about 200 h.p. to make 10 knots but twice the amount, or 400 h.p., to make 11 knots. The same amount of power which raised the speed from 0 to 10 knots is required to increase it from 10 to 11. It emphasizes the importance of not installing a too powerful engine, at unnecessary cost, which weighs down the hull and takes up unnecessary space. It is evidently most uneconomical to double the engine power only to increase the speed from 10 to 11 knots. If the higher speed is absolutely necessary something else must be changed, i.e., the boat should be made longer and/or lighter.

The full drawn curves given in *Figure 3* are ideal, and if better values are claimed they should be checked carefully as they might not be correct. *Figure 3* also shows results from some average boats (lines in dashes) and it can be seen that such a 65-ft. (20 m.) boat will require 300 h.p. to make 10 knots instead of 200 h.p. as in the ideal design. The curves are plotted on the basis of results from model tests with boats of traditional design before attempts at improvement started. The values can be considered as typical for many fishing boats in use today.

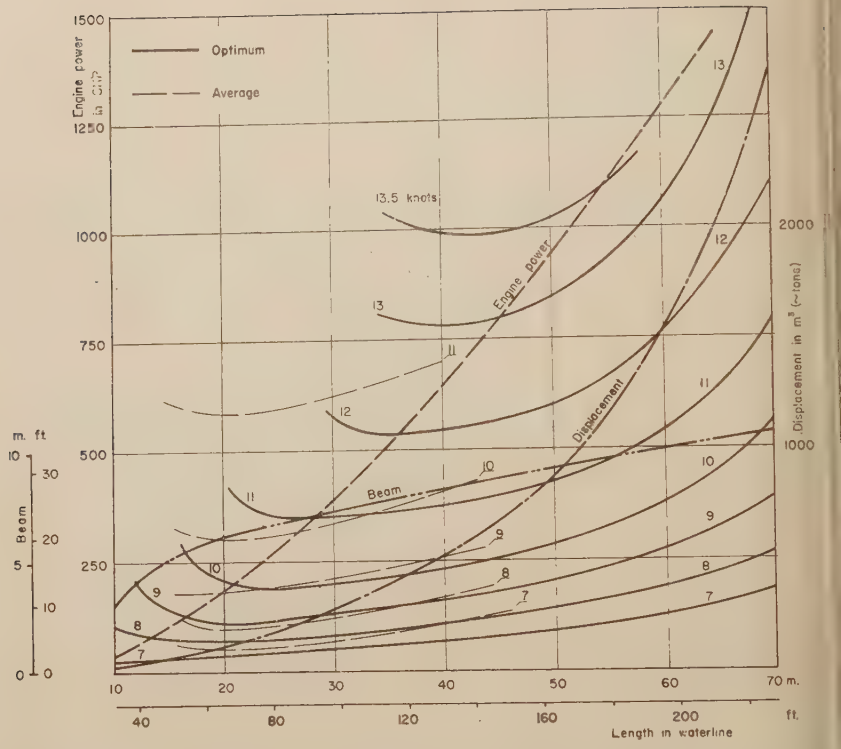


Figure 3. Curves are given for displacement and beam of typical fishing vessels from 33 to 230 ft. (10 to 70 m.). A corresponding curve is given for the built-in engine power. Curves are also given for the power necessary to propel such boats at certain speeds. The solid line curves are for optimum boats and indicate how far the necessary engine power can be reduced if the hull shape is as favorably designed as possible. The lines in dashes show corresponding curves for average fishing boats in use today. The difference between the curves in dashes and the solid line shows the room for improvement of many fishing boats. All curves have been developed on the basis of model tests with a large number of fishing boats, and in order to transfer figures for effective (tow rope) horse power to engine power in SHP, the propulsive efficiency has been assumed to vary proportionately from 50% for 65.6 ft. (20 m.) boats to 60% for 230 ft. boats for optimum results. For the average results a lower propulsive efficiency has been assumed — one varying proportionately from 45% for 65.6 ft. boats to 55% for 230 ft. boats. The solid line curves for the optimum boats must be regarded as extremely good and any claim for better results at the corresponding displacement should be checked very carefully. It shows how far fishing boats can be improved if one makes use of the most recent experiences in naval architecture.

When calculating the curves in *Figure 3* it was assumed that the total efficiency of propulsion for the optimum values increased from 50% for 65 ft. boats to 60% for 230 ft. (70 m.) boats. Similarly, the total efficiency of propulsion for the average boats was assumed to increase proportionately from 45% for 65 ft. boats to 55% for the 230 ft. boats. These values are naturally rather arbitrary but it is believed that with modern hulls and good propellers a 5% difference can be counted on.

Figure 4 shows curves for the values given in *Figure 3* for boats aving 65.6 and 98.4 ft. (20 m. and 30 m.) water line length. It shows ow big the difference can be between an average design and an ex-

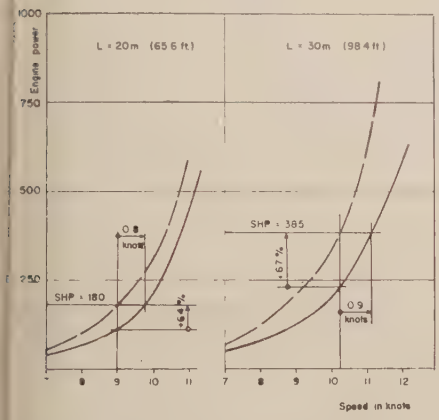


Figure 4. Cross curves for boats with 65.6 and 98.4 ft. (20 and 30 m.) water line lengths taken from *Figure 3*, showing the difference between average and optimum designs. The engine power indicated in *Figure 3* shows the difference in speed and fuel consumption for a boat of average design compared with one of optimum design. The differences between average and optimum designs are spectacular but it should be remembered that when computing the curves in *Figure* 3, 5% better propulsive efficiency was assumed for the optimum curves.

remely good one. It should, however, be remembered that the values or the optimum designs can only be achieved by considerable work, study of available experience and experimentation. Sometimes the conditions of fishing might require a hull shape which is not as efficient as would be possible from a purely naval architectural point of view. When it is up to the owner and naval architect to decide how much should be sacrificed on the efficiency of hull design to obtain a certain advantage in general arrangement But such compromises have seldom to be made, and it is possible to design the optimum hull which is at the same time best also from the fisheries point of view.

The weight of hull, machinery and cargo plays an important role in the fuel consumption of fishing boats. *Figure 5* shows an average fishing boat tested on three different displacements. An increase of total weight from 100

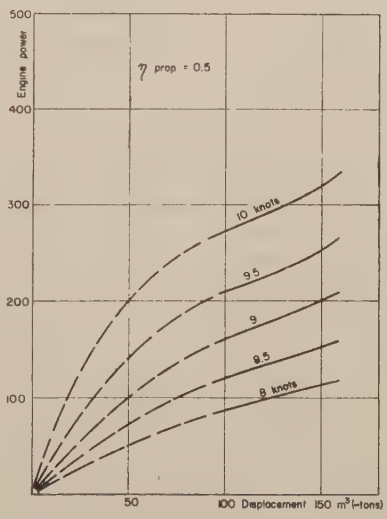


Figure 5. When loaded, a fishing boat will require more horse power to maintain the same speed. The diagram shows a particular fishing boat which, when the displacement is increased by 50%, requires an additional output of the engine of 25 %. It is important to keep the weight of hull and ballast down so as to maintain the lowest possible resistance.

4

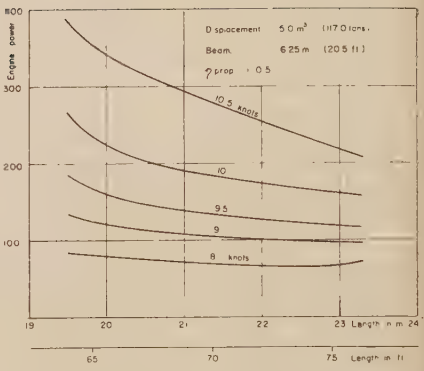
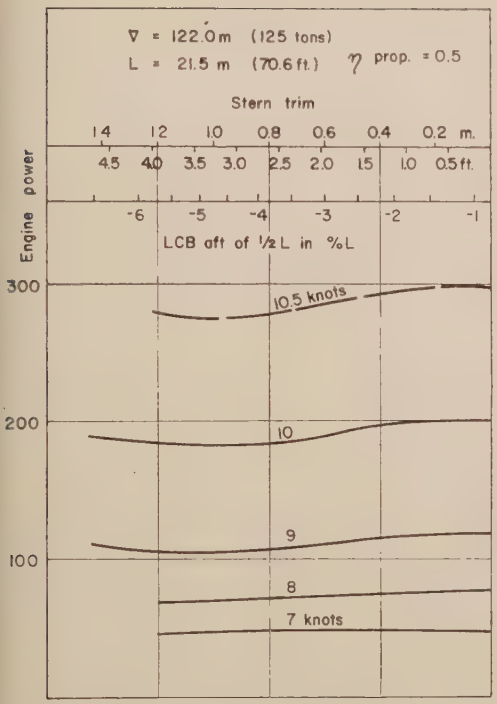


Figure 6. If the displacement and the beam of a boat are kept the same but the boat is lengthened, the necessary engine power will decrease more than was shown in *Figure* 3 where the displacement was increased in relation to the length. This diagram shows how a fishing boat, when lengthened from 65.6 to 75.5 ft. (20 to 23 m.) required 160 h.p. at 10 knots instead of 220 h.p., a reduction of 27 %.

tons to 150 tons, or by 50%, at 9 knots will require 25% larger output of the engine in order to maintain the same speed. An increase of weight, therefore, does not mean a proportionate increase in power, but designers have to be careful not to make hulls heavier than necessary or to design them so as to require permanent ballast to be carried. A striking example of the decrease of power when the displacement and beam is unchanged but the boat lengthened is given in *Figure 6.* It shows how a 65.6-ft. (20. m.) boat will require 220 h.p. at 10 knots but when lengthened by 10 ft. (3 m.) to 75 ft. (23 m.) will only require 160 h.p., i.e., by merely lengthening the boat the resistance, and thereby the fuel consumption, decreases by 27%. The reason is, of course, that the boat will travel in a lower speed/length ratio where the specific resistance is lower. This diagram should be studied together with *Figure 3* which shows the changes in required horse power when the displacement is also increased.

Fishermen have always appreciated the influence of trim, and after delivery they frequently re-arrange or add ballast in order to obtain the best possible trim of their vessels. Then they often find that a trim by the stern is the best. There are different reasons for this. One is that the propeller gets better submersion and that less aerated water is soaked into the propeller. It is found from the design of large ships that the center of buoyancy should be rather far aft of the midship section in ships traveling at high speed/length ratios. A center of buoyancy 2% aft of mid-length has been considered to be the optimum position. An investigation of quite a number of model tests with fishing boats shows quite clearly that for these somewhat beamier and heavier ships the center of buoyancy can be still further aft, as far aft as one can get it by placing heavy weights, such as engines, fuel, tanks and superstructures as far aft as the hull shape would allow.

Figure 7 shows influence of trim and of the location of the center of buoyancy of a specific fishing boat model. It is quite evident that the center of buoyancy 3 to 6% of the water line length aft of mid-length gives, in this specific case, the lowest resistance. The center of buoyancy is naturally only an expression for the type of shape. With the center of buoyancy far aft a sharp entrance is obtained



contrary to the full forebody which is the result of having the center of buoyancy far forward. One of the reasons for the decrease in resistance with the center of buoyancy far aft is that the angle of entrance plays a very important role in the resistance of such relatively fast vessels as fishing boats.

Figure 7. The fishermen know that by trimming their boats after delivery they might obtain a better speed. This diagram shows how the resistance decreased when a certain boat was tested with a large variation of trim. It also shows the corresponding location of buoyancy for the different trims and that the center of buoyancy should be as far aft as possible.

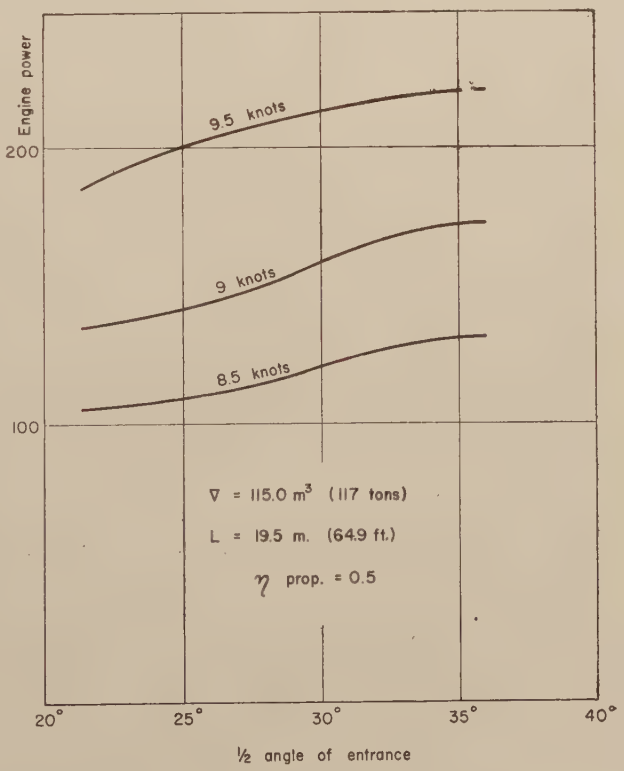


Figure 8. The angle of entrance of the water line is a typical measure of the shape of fishing boats. Experience has shown that a sharper angle of entrance gives less resistance. This diagram shows how a certain type, having a half angle of entrance of 36°, required 173 h.p. to make 9 knots. When the angle of entrance was decreased to 21 1/2°, the necessary power decreased to 135h.p. In other words, a boat with a fuller entrance angle required 27 % more power.

VIII. Importance of Sharp Entrance

Figure 8 shows the reduction in resistance of a type having the same displacement and the same water line length but in which the half angle of entrance was decreased from 36^0 to $21\frac{1}{2}^0$. At 9 knots the boat with the fuller entrance angle required 27% more power. Investigation into quite a number of model tests proves that the half angle of entrance of the datum water line of fishing boats should be less than 25^0 for smaller boats and less than 20^0 for medium sized vessels, The maximum beam in the water line necessarily limits the entrance angle and as the smaller boats have proportionally larger beam, their entrance angle will be larger. One does not seem to gain very much in making the entrance angle extremely knife-sharp or the water lines hollow. The water line can run straight and turn nicely at a point slightly aft of mid-length into the aft body. A forward shoulder should be avoided.

The need for having a relatively sharp entrance for fishing boats has frequently been challenged and one of the arguments against it has been that such a ship would be more liable to pitch than a ship with a fuller water line forward. It appeals to common sense that a fuller water line should better obviate pitch than a sharp one, but as the center of pitching in a ship with sharp forebody will be further aft and the lever to the center of buoyancy of the over-water part of such a foreship will be longer, the momentum to raise the bow will be greater. Hunter (1952) has very clearly shown (*see Figure 9*) how a foreship with a sharp entrance and raked stem resists pitch better. There has also been a number of model tests with both small and large fishing boats carried out in a head sea which have all proved that the sharp forebody produces the better ship from a pitching point of view, and a ship which loses less speed in a head sea. The advocates of a full forebody naturally do not acknowledge the validity of such model tests, but in this connection they should remember the development of the large British long distance trawlers. They had full forebodies before the war but after the war, due to the experience gained from model tests, they have been sharpened considerably. Every modern British trawler today has a sharp forebody. The writer has had some opportunity of discussing the differences with trawler men who had experience of both types, and they said that they would never want to sail again with a trawler having a full forebody. If the advocates of the full forebody had also had the opportunity, like the writer himself, of going out with small fishing boats with sharp forebody, they would probably better appreciate the experience of these British trawler men.

Möckel (1955) has investigated the loss of speed in different types of weather of a trawler being outward bound and trimmed down by the stern, and homeward bound and heavily trimmed down by the head because of the full fish hold. The speed loss in the condition when trimmed by the bow and sailing against seas was considerably greater than in the case of stern trim. For example, with the wind at Beaufort No. 6, the speed loss on the outward trip amounted to 8% while on

the homeward voyage in similar weather it was 15%, or nearly double. During this homeward voyage the vessel had a fuller water line forward and this was the reason for the greater loss of speed.

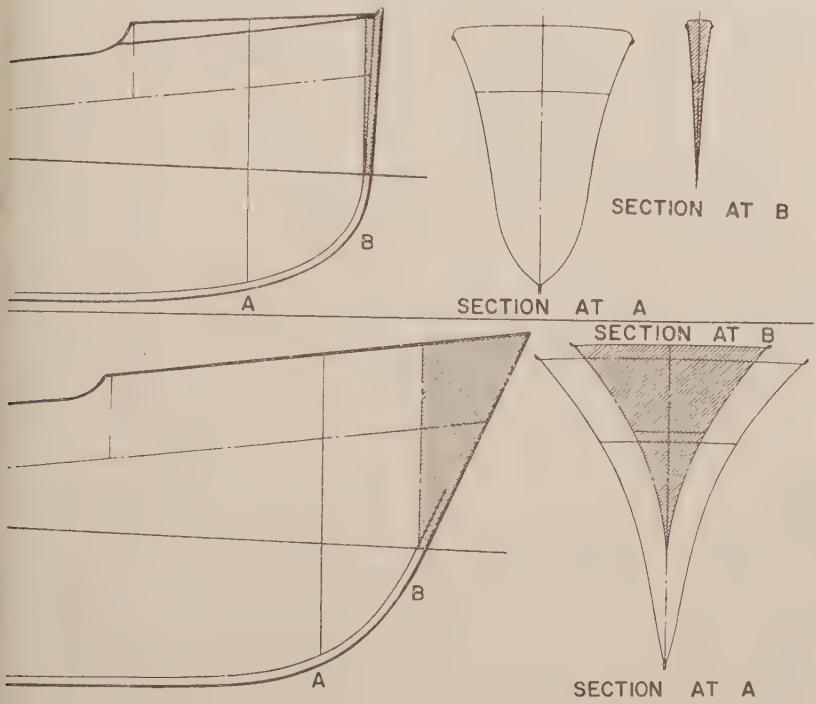


Figure 9. It is often appreciated that the sharp angle of entrance will produce a boat with less resistance in smooth water but, at the same time, many people maintain that such a boat will pitch heavily and be a bad sea boat. The famous British trawler builder, Ambrose Hunter, has shown here how a modern trawler with a sharp angle of entrance and with raked stem will have a better chance to resist pitching. His experience is based on a considerable number of model tests in both smooth water and artificially made waves and on the success of his post-war trawlers.

The angle of entrance of a ship is only one way of determining the general shape of a vessel. If a boat having a fine angle of entrance has badly shaped shoulders or aftbody, it does not necessarily have to be a low resistance boat. Similarly, a boat with very large cutaway forefoot and a comparatively large angle of entrance might have the same resistance as a smaller angle entrance boat having an angular forefoot. However, the angle of entrance is one simple way of measuring the sharpness of a hull.

IX. Block Co-efficient

The most well-known co-efficient to measure the sharpness or fineness of a hull is the block co-efficient. One particularly thinks and speaks much in terms of block co-efficient in connection with the de-

sign of large vessels. *The block co-efficient is the relation between the volume of the submerged part of the ship and the volume arrived at by multiplying length, beam and mean draft.* In the design of merchant ships it is the general experience that a smaller block co-efficient gives lower specific resistance. Merchant vessels normally have as large a midship section as possible in order to make the best of the restricted drafts and beams of such vessels. Fishing boats, however, seldom have such full midship sections in order to utilize the beam and draft. On the contrary, many fishing boats have a fairly large dead rise ; round bilges and even the keels go down in a reverse curve. It is evident that if one has a certain set of lines without such a reverse curve to the keel and the resulting block co-efficient is, say, 0.5 and the draft is increased by adding a reverse curve to the keel to the same set of lines, the displacement will not be changed much, nor will the general resistance of the ship. But, because of the fact that the product of the old length and beam and the new increased draft will be larger, there will be a smaller block co-efficient of, say, 0.4. Those who work on calculations from the design of merchant vessels will believe that the new type of lines will have less resistance, but such will not be the case.

X. Prismatic Co-efficient

Instead of thinking of the block co-efficient as an expression of the fineness of a fishing boat hull, advanced fishing boat designers today think in terms of the prismatic co-efficient and feel that this is a better expression to describe the distribution of the displacement. The main difficulty in using the prismatic co-efficient is that it is somewhat more difficult for the layman to understand. *The prismatic co-efficient is the relation between the volume of the submerged part of the ship and the volume arrived at by multiplying the length and the area of the midship section (instead of beam by draft as in the case of the block co-efficient).* In *Figure 10,* an attempt has been made to illustrate what it is. This co-efficient is, in fact, no more difficult to determine than the block co-efficient. The only new factor which has to be introduced into the calculation is the area of the midship section.

A prismatic co-efficient of 0.575 is recommended by the writer (Traung 1951, 1955). Naturally, such a value is not absolute. Various ratios of main dimensions, of length/displacement and of speed/length, all require a somewhat different prismatic co-efficient in order to produce the lowest resistance at a specific speed. The value 0.575 is selected to cover the most common combinations and to give the fishing boats a low resistance over a wide range of operating speeds. If applied, one would seldom experience more than 5% higher resistance than would be achieved by the absolute optimum prismatic co-efficient at one particular speed, and set of conditions.

The opposition from some quarters to the use of the prismatic co-efficient as an expression of the fineness of the form and as a recommendation for the form to use on fishing boats is difficult to understand. The

PRISMATIC COEFFICIENT φ

$$\frac{\text{Submerged volume } \nabla}{\text{Length } L \times \text{Midship section area } A_m} = \varphi$$

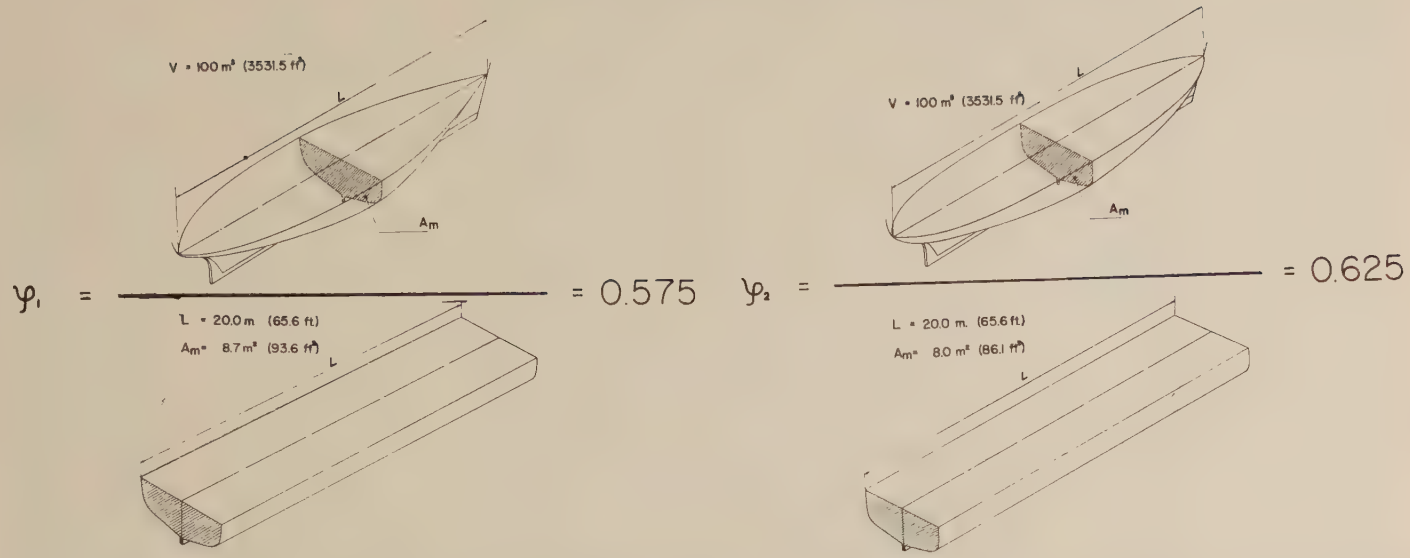


Figure 10. The best measure of a boat's sharpness and the distribution of its displacement is the prismatic co-efficient. This figure shows how the prismatic coefficient is calculated. A low prismatic co-efficient boat has a full midship section and fine ends, contrary to the boat with a large prismatic co-efficient which has a small midship section and blunt ends. This paper maintains that all normal fishing boats should have a lower prismatic co-efficient than normally used today.

classic textbook in naval architecture by Admiral Taylor already used in its first edition in 1910 the prismatic co-efficient as a main parameter for the selection of the type of hull shape. Other workers have used it and advocated it for the design of large ships. An extremely clear exposé of its influence upon resistance at different speeds appears in a paper by Roach (1955) which gives a number of diagrams based on

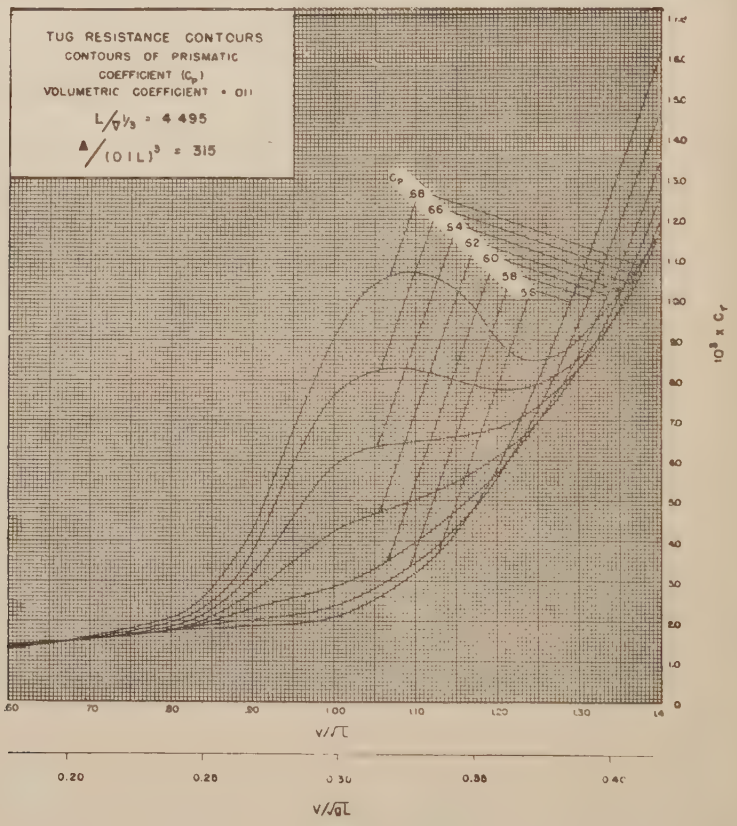


Figure 11. Much can be learnt by studying fishing boats from the different countries and by studying experience gained from similar types of boats. Roach (1955) and Taggart have investigated the lowest resistance for tugs and laid down their findings in a series of diagrams. These show the data for hulls with an average length/displacement ratio used in fishing boats and shows that for the speed/length ratios used by fishing boats the lowest prismatic co-efficient should be about 0.56 to 0.58.

an investigation by Taggart. These diagrams, of which *Figure 11* is a typical example, show clearly that for the different length/displacement ratios applicable to most fishing vessels, the lowest resistance will be achieved by a prismatic co-efficient of 0.56 in speed/length ratios from 0.85 to 1.15. For fishing boats having relatively large displacements on a given length, these curves also show that the resistance for

a prismatic co-efficient of 0.58 is very little higher than that with a co-efficient of 0.56. On the other hand, a prismatic co-efficient of 0.58 produces lower resistance at speed/length ratios of 1.15 to about 1.20. Now, fishing boats might sometimes, especially when they are over-powered, be able to run faster than speed/length ratio 1.2 on trial runs, but *Figure 2* shows clearly that under average conditions fishing boats seldom run faster than speed/length ratios of 0.9 to 1.1 at which the recommended prismatic co-efficient of 0.575 will produce low resistance. A prismatic co-efficient of 0.56 might give slightly less resistance but fishing boats are comparatively beamy and it is sometimes difficult to design a 0. 56 prismatic fishing boat without making its belly too pronounced amidships. It seems to be folly to design boats with a high prismatic co-efficient to get a lower resistance at trial runs with unloaded hulls instead of designing them for the average speed at which they are going to sail.

FAO naval architects have evaluated a number of model tests with fishing boats to determine if the recommendation of the value of the prismatic co-efficient should be modified. They have recently carried out model tests with a Pakistani fishing boat on a rather large length/displacement ratio, that is, a boat with a somewhat small displacement on the given length. It was felt that these conditions had not been explored fully before but again the recommended prismatic co-efficient of 0.575 was clearly confirmed. The tests were carried out with models having prismatic co-efficients from about 0.5 to about 0.65 and the results are given in *Figure 12*.

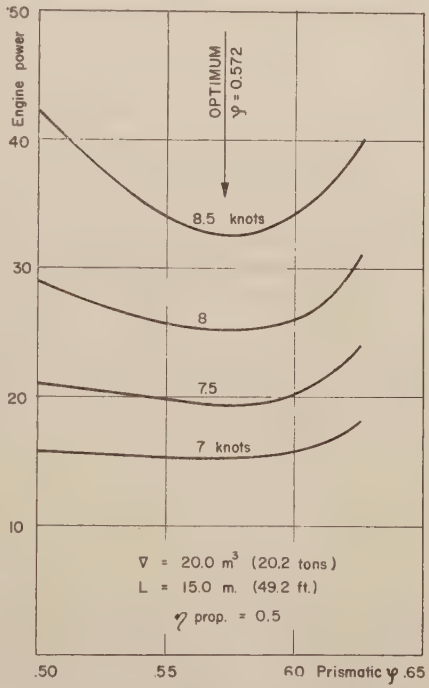


Figure 12. FAO has carried out model tests with a number of Pakistani type fishing boats of various prismatic co-efficients. This diagram for the average loaded condition proves that the optimum prismatic co-efficient is about 0.575.

XI. Shape of the Aft Body

If the correct prismatic co-efficient is chosen for a design and the lines are shaped so as to produce a center of buoyancy as far aft of midship as the center of gravity of the boat will permit, one has already

avoided some of the most common pitfalls in the design of a fishing boat. The type of the sections above water is naturally also important, and it is especially important to give boats a moderately raked stem so that the forward sections can be designed with a good flare, as illustrated in *Figure 9*. The aft body requires some consideration. It has partly to be full to allow the engine to be placed as far aft as possible, but one has also to make sure that the propeller is sufficiently submerged and receives a good flow of water. The shape of the stern has also very significant influence on resistance. The old type of counter stern requires unnecessarily large power but some modifications of it are successful, such as the fan-tail stern used on the west coast of the United States

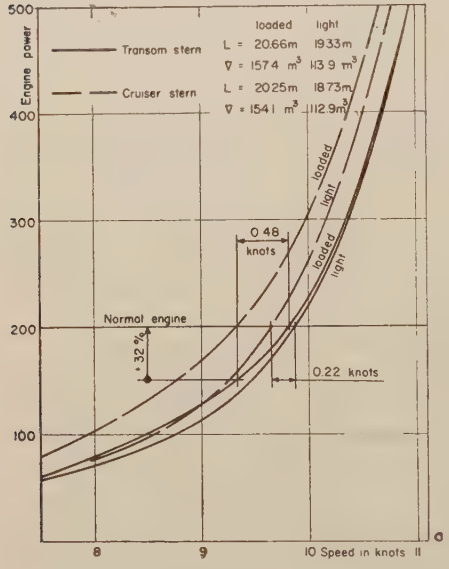


Figure 13. The shape of the stern of a fishing boat has a considerable influence upon resistance, especially in the loaded condition. It is shown here that the mere addition of a transom stern can increase the speed in the loaded condition by about 0.5 knots or decrease the fuel consumption by 31 %. The advantages in the light condition are not as spectacular but they indicate an increase of speed by about 0.2 knots, which does justify its use.

of America and in some places in Brazil, where it has been shaped so as to allow the water to leave the vessel fairly undisturbed. It gives the boat a better buoyancy aft than the cruiser stern which is now being introduced into many fishing boat types. Another type of stern, the transom, has been used by many good fishing boats in different parts of the world for centuries. The excellent resistance characteristics of Newfoundland schooners and Pakistani bedi boats are due, to a large extent, to the adoption many years ago, of the transom stern. Model tests have been made to find out the effect of a transom stern upon resistance and they have clearly shown that great savings in power or increases in speed can be made with a correctly shaped transom stern. In most instances these tests have shown that the transom stern is more profitable than the cruiser stern, especially in the loaded condition (*see Figure 13*). The reason for its efficiency is that it has flow characteristics similar to a longer boat with a canoe stern. The boat thus runs at a lower speed/length ratio, which gives less specific resistance. With a transom stern the angle of the aft water lines can be made to produce less eddies.

Bad weather performances of transom sterns, when used in small merchant vessels, have been encouraging. People have particularly criticized them from the point of view of sea-kindliness, yet the discussions at the FAO Fishing Boat Congress proved clearly that anyone having had personal experience with such transom sterns was greatly in favor of them. As in many other respects with regard to suggested improvements of fishing boats, those who had tested the transom are mostly in favor of it, while those who oppose it have had no experience with it. Furthermore, the transom stern is less expensive to construct and gives a better deck area aft.

XII. Importance of Sharp Propeller Posts

Everybody appreciates the importance of shaping the stern post of fishing boats as sharply as possible in order to let the water flow to the propeller undisturbed. It is said that a sharp stern post might decrease the necessary power by 5%. FAO naval architects have recently made some tests with a sharp *versus* square propeller post on a Pakistani fishing boat and found that on this type of boat, with a relatively low basic resistance, the influence of a square propeller post is quite spectacular. It was, in fact, not less than between 12 to 14%. At the same time the effects of sharpening the stem post were investigated and this was rather less — 5%.

XIII. Scope for Improvement

This review of recent experience of how a good fishing boat hull should be designed was made in order to clarify how much existing fishing boats can be improved and along which lines such improvements must be made if one wants to design the superior ships indicated in *Figure 3*, which shows that improvements of 30 to 50% can be made. It should, however, be pointed out clearly that the values in *Figure* 3 cannot be achieved without work and careful study of the conditions in each specific case.

XIV. Sea-kindliness

There is an axiom in many circles that a design which has proved to have little resistance in a model test will be a bad sea boat, or a boat lacking in stability ; or that such a design which has only been tested in so-called resistance tests and shown low resistance will have a lower efficiency of propulsion than the boat with a high resistance. Few self-propulsion fishing boat tests have actually been made, but those made clearly show that the design with the low resistance also had a higher propulsion efficiency. Similarly, many extensive model

experiments with larger merchant ships show that the low resistance ships normally have a higher propulsion efficiency. A few fishing boat model tests in artificial waves, such as reported by Todd (1938) and Allan (1951), show that the low resistance ship loses less speed in waves. It is known to the writer that a number of similar tests carried out with other types of fishing boats in the United Kingdom, Western Germany, the Netherlands and France but not published, have shown the same result, that ships with low resistance in smooth water are also better sea ships. In this connection the development of the British long distance trawler, a typical example of low resistance boats developed after considerable model experiments in both smooth water and waves, should not be forgotten. The builders of these trawlers have not published any results, but the plain fact that the boats are being used and built and the crews are satisfied with them should be enough to quieten those people who try to convince fishermen that boats cannot be improved.

Naturally, if a certain design with a large prismatic co-efficient is improved by making the ends sharper without changing the beam, the water line will have less area and less moment of inertia. In addition, the midship section will be fuller towards the bottom and the center of buoyancy of the hull will be somewhat lowered. This means that the metacenter which determines the stability will similarly be lowered and the resultant design will have a less metacentric height than the original design. If the old design had just sufficient stability the new stability evidently would be too low and the boat would be dangerous. If the resistance qualities of a boat are improved in this way without remembering first to check the stability, then those who claim that model tests produce unstable boats would be right. However, the careful designer will always be aware of this fact and he will see that the new design is changed so as to get the correct amount of stability. In fact, it is simple enough to enlarge the beam somewhat, thereby restoring the old position of the metacenter, and normally, it will even produce a boat with still lower resistance. It has been proved many times that the beam on fishing boats can be increased without any penalty. It should not, therefore, be impossible to design improved boats having the qualities shown in *Figure 3* which at the same time will be better sea boats and have sufficient stability.

XV. Propellers

The selection of proper propellers should not be difficult as very much practical data from research exist in this field, but many fishing boats still have unsuitable propellers giving a low efficiency. This refers back again to the problem of estimating the correct speed. If a fisherman tells either an engine or a propeller manufacturer that his boat is able to run 2 knots faster than it can, it is understandable that his new propeller will be of the wrong dimensions — mostly too high a pitch — with the result that he cannot run his engine at full r.p.m.,

thereby being unable to use the full output of the engine. In this connection it is amusing to read certain advertisements for engines where a certain low hourly fuel consumption is claimed. A fisherman buys a new engine of a certain horse power and certifies that the fuel consumption is only so many gallons. Knowing the specific fuel consumption of such an engine, it is easy to find out that the fisherman is not using the full output of the engine. There is also the possibility that the engine manufacturer does not dare to let his engine develop the advertised horse power and has limited his output in some way, resulting in the advertised low total fuel consumption.

Because of the difficulty in determining speeds, also because fishing boats in fact sail at very different speeds in varying weather conditions and when dragging fishing gear, the use of controllable pitch propellers is recommended. In some countries, such as Scandinavia, controllable pitch propellers are almost exclusively used in fishing boats, but in most other parts of the world there seems to be ignorance of their possibilities or fear that they should add mechanical complications, requiring large maintenance costs. This probably arises because some novel designs of controllable pitch propellers have been too complicated and have not got over their teething troubles. It is rather remarkable that nobody tries to copy the very simple types of controllable pitch propellers used in Scandinavia. A point worth considering is that with a controllable pitch propeller a reverse gear is eliminated.

The need for maximum power during trawling is sometimes exaggerated. The writer has actually found in several instances during fuel measurement tests while trawling, that only 50 to 60% of the full output of the engine is used. It is therefore not always advantageous to have a controllable pitch propeller, because it is not always necessary to utilize the full output of the engine during trawling. A controllable pitch propeller does, however, offer good manœuvering qualities.

The use of a shrouded propeller, the so-called Kort nozzle, has many advantages, especially for trawlers. It increases the pull during trawling (normally by some 25%), protects the propeller from the trawl wires and, with modern Kort nozzle rudders, the boats have an excellent maneuverability. Furthermore, tests with Kort nozzles on trawlers have proved that these boats pitch less in a seaway and can therefore sail at higher average speeds.

Vertical axis (cycloidal) propellers, such as Voith-Schneider propellers, are now being used more and more in tug boats because of their excellent maneuverability. It has been shown that such propellers, having the load co-efficients common for fishing boats, can give the same efficiency as normal screw propellers. A novel improvement is that the separate blades can be exchanged from inside the vessel without docking. The price, however, seems still to be rather too high to justify their application in the average fishing boats.

An active rudder, that is, a normal rudder with an electrically driven propeller in a ring or nozzle, has lately been adopted for a num-

ber of German fishing vessels. This propeller has about 10% of the power of the main engine. It has been shown from full-scale trials that, when both propellers are working in a tandem, there is no loss of efficiency, as when the total power is delivered by the main propeller. Such an installation has two advantages. The maneuverability, especially in harbors, is excellent, and even large commercial vessels can be berthed without the assistance of tugs. For fishing vessels the rudder propeller is very useful, especially when hailing drift nets. Furthermore, in fisheries research vessels such an installation might make it possible to do away with expensive and complicated engine arrangements such as diesel electric drive, controllable pitch propellers, etc. so far as the questions of maneuverability and operation at low speeds are concerned.

When the true values of the speeds at which fishing boats will operate are known, there should be no great difficulty in selecting propellers with a high efficiency. One must also know the wake in order to estimate the correct speed of advance of the propeller. There are today a number of textbooks available which give useful information about the proper calculation of propellers, based on extensive model experiments. Unfortunately, there is still too much rule of thumb used in the propeller selection by some engine builders, and some naval architects do not take the time to check propellers suggested by engine manufacturers.

XVI. Selection of Engines

The naval architect could also play an important role in the proper selection of engines for fishing boats. There is constant advancement in the production of different models of engines. A relatively new development for fishing boats is the super-charged engine which makes up to 50% higher output possible on the same cylinder volume. Other developments are the V-built and opposed piston engines which make it possible to reduce the size of the engine room, thereby increasing the cargo room. If one wants to keep the volume of the cargo room constant, the size of the vessel can be decreased, reducing, of course, the total construction costs correspondingly. A naval architect can be of great help to the operator in comparing objectively the different types of engines for a certain project and by studying their effect upon design and propulsive efficiency and comparing purchase and maintenance costs. In fact, the proper procedure when designing a boat, after deciding on the size and type in general, is to select the engine and then design the boat around it. One nightmare for most naval architects is to fit an ill-selected engine into a certain design and many a good design has been spoilt by installing larger and larger engines without suitably changing the design.

XVII. Hull Construction

The naval architect will, in future, play a bigger role in the proper design of the structure of the hull as such. In olden times the standard of construction was relatively settled and the architect

had only to use the usual standard. Nowadays, with the great increase in prices of both material and labor, it is up to him to find new ways of saving on material and labor and to show the classification societies that such constructions will have strength equal to the old one. The introduction of new techniques and materials, such as welding, glueing, laminating, light metals, plastic and rubber forces him to study all these materials so as to be able to use them to best effect in his new designs.

The whole problem of scantlings has to be reviewed in order to find out what are the minimum requirements for certain types. Some countries require their fishing boats to be built with scantlings which evidently are too heavy and which make the boats expensive, uneconomic and ineffective. Other countries have no regulations and boat builders are gradually reducing scantlings so that one day severe government regulations may have to be introduced to maintain safety at sea.

It is an unavoidable fact that government regulations have to be designed to cope with unreliable builders and that the dimensions they require are too heavy in the case of the skillful and honest builder using top grade materials and fastenings.

Wood will still be the most important material for the construction of fishing boats for years to come and naval architects should familiarize themselves with the ever-increasing knowledge of the technology of wood so that they can employ its strength to the best advantage and preserve it against rot, toredo and fouling. The replacement of sawn frames by steam-bent frames has many advantages. In the first place it is not only cheaper but leaves a larger volume inside the boat, thereby making it possible either to build the boat smaller or give it a larger capacity.

New plastic materials have already been used in many fishing boats and a time might come when it will be cheaper to construct hulls entirely of plastic, rather than any of other material. The great development in plastic in small boat construction should be followed closely.

Rubber is an important material which is now used for life rafts and might one day be used for small inflated auxiliary fishing boats, thus solving storage problems aboard mother ships, etc.

XVIII. Work to be Done

Naval architecture is only in its infancy in fisheries and there remains an enormous amount of work to be done on many basic points. Although it has been generally stated that boats with lower resistance are superior sea boats, much work has to be done to clarify the behavior of fishing boats in different types of sea, running to and from the fishing grounds and towing or handling gear. Möckel (1955) has shown how much can be gained from actual measurements of trawlers at sea. He is now engaged on a large project investigating many more fishing boats and extending his measurements to determine the centers of movements and other important factors. His work is mainly

confined to large trawlers but if such work could be extended to fishing boats of other countries and of other types and sizes, data would probably be gained which would allow the naval architect to design more economical fishing vessels. After all, if fishing could be carried out in a wider range of weather, and if fishermen could be better protected against the hardships of the sea, the efficiency of the operations could be increased with a resulting gain to fishermen, owners and the public. It is also important to have naval architects go to sea to make "time and motion" studies to investigate, as is done in any large factory, the most appropriate methods of handling of gear. Time and motion studies have shown conclusively that improvements can be made even where, from a common sense point of view, a high degree of efficiency exists. It is not always realized that a fishing boat is a larger asset than many a factory employing several "time and motion" study technicians. Much work has still to be done on scantlings and new materials. In applying the results from already published model tests to fishing boats, a naval architect should be able to design a hull with relatively low resistance. And, as in the design of a merchant ship, the architect in the future will be able to improve these designs still further with the help of actual model tests.

The naval architect's contribution to fisheries will be considerable if he works to improve safety at sea. It is not only a question of life and suitable working conditions, but also of safety against breakdowns and economic losses which affect all concerned. At present many talk about the hardships of the fishermen but few do anything to mitigate them.

The success of fishing depends to no small extent on the proper handling of the catch. Much progress has been made in the design of efficient holds and the best way to keep fish fresh in them. Governments are sponsoring far-reaching research in fish handling, and fish technological laboratories in many countries are spending a large amount of money on this type of research. Much is being done to bring experience gained to the knowledge of the fishermen and operators, but so far it does not seem as if naval architects have been able to establish any closer co-operation with the processing technologists. Naval architects have much to learn in this respect in order to implement the findings of the technologists. In this connection, they have also to study the possibilities of different types of refrigeration and to be aware of the danger of over-estimating the mechanical refrigeration. Ice is still the most important medium for bringing down the temperature of fish as quickly as possible and many types of fish, if properly iced, stored and taken care of, will keep fresh for quite a long time in a fish hold. It is a fact that most mechanical refrigeration plants on board fishing boats are unsuccessful because they are not big enough to justify a refrigeration engineer being included in the crew.

Naval architects also have much to do in designing fisheries research vessels. Most research vessels today are planned by biologists and the naval architect is merely used as a draftsman. Governments do not seem to appreciate fully the importance of spending the neces-

sary funds on experienced naval architects to enable them to study the problems involved in developing a successful research vessel. They frequently try to use an available fishing boat design to save on the design fee. They then add equipment and accommodation. They do not consider that such a vessel might then operate under quite different conditions of loading and stability from those for which the original fishing vessel type was designed. If given the necessary time and recompense to develop a research vessel, naval architects with experience of fisheries would be able to design better research vessels than are being built in many instances today.

The naval architect's contribution to fisheries will be especially important in the mechanization of fishing boats in underdeveloped countries. He has to assist in the proper selection of engines, their installation, the operation and maintenance of the boats and engines, as well as in additional mechanical aids, such as winches.

XIX. Increased Recognition of Naval Architecture in Fisheries

The FAO Fishing Boat Congress in 1953 has resulted in greater interest and understanding of the work of the naval architect in fisheries. Since the Congress excellent papers on fishing boat design have been published in a number of journals in different countries, and professors of naval architecture have also begun to take an interest in the design of fishing boats.

Young naval architects today can have an excellent future if they decide to take up fishing boat design. So much remains to be done. Improvement of present boats is relatively easy, even if the ultimate refinements might require considerable work and research. There is, however, a wealth of experience and data available which can be useful if rightly interpreted, and ideas can be exchanged between designers in different places.

The yearly catch of fishing boats is normally less than the total investment in them. A large Swedish fishing boat, costing S. Kr. 210,000, has a yearly catch value of about S. Kr. 180,000, and a new 94-ft. (28.6 m.) Boston trawler, costing U.S. $200,000, under very good conditions, catches fish worth about U.S. $165,000.

The fuel costs for fishing boats in a developed fishery are often quite high compared with the total investment in the boats. On the Swedish west coast the yearly cost of fuel and lubricating oil is more than 15% of the total investment in the fleet. A reduction in the fuel cost through better design of the vessel plays an important part in the economy of such fishing boats. If a Boston trawler has a yearly fuel cost of U.S. $14,200 and each of the eight crew members were making U.S. $8,400, which is the case in a certain high liner, and the fuel costs could be brought down by 30%, the savings could be given as a salary increase to the crew members, which would mean that each man would get an addition of U.S. $500 a year — or, in other words, that the profit of such a boat would increase by U.S. $4,250. By changing the shape of the hull, the fuel cost of S. Kr. 25,000 of the

Swedish boat could be reduced by 30%, thus increasing the share for the crew members by 10%, or, alternatively, the part left for depreciation and interest would be increased from 12.8 to 16.4%. If, in this case, the interest and depreciation is 12%, the profit would increase from 0.8% to 4.4%, or by more than five times.

Furthermore, fishing boats often have very strong engines in order to drag fishing gear in great depths and during heavy weather. Very often, through casual handling, they continue to use the full output of their engines during periods of better weather also. The operators do not realize that a decrease of the free speed of 0.2 to 0.3 knots, corresponding to an increase in the sailing time to and from the fishing grounds of only 2 to 3%, rather than being a disadvantage, would mean about 20 to 30% decrease in the fuel consumption and a correspondingly smaller wear and tear of the engine. Here the naval architects have a role to fill to show fishermen, in an easily understandable way, how to operate their vessels with the utmost economy of equipment.

Unfortunately, fishing boats in general are very sparsely equipped with such simple and inexpensive instruments as fuel meters, exhaust gas thermometers, etc., and if naval architects could help to introduce such and other similar gadgets and demonstrate how they should be used, they could do much to improve the economy of many fishing fleets.

Why are there so few naval architects, if they are so essential to fisheries ? There may be some 300 naval architects in the world who are mainly occupied with the design of fishing boats, and most of the plans of fishing boats today are made because of government regulations and because shipyards want them as a guide for construction. Sometimes, though not often, an operator wants an old design developed. To a large extent, the reason why there are so few architects in this field is that carefully made plans based on a development of an old design require considerable study and the cost for such plans might be as high as 5 to 10% of the total cost of the vessel. Here governments can help in having plans made. It is difficult for the fisherman to appreciate what he can gain from expenditure on drawings and he prefers to put his money into a larger engine or some more fancy accommodation. Another obstacle is that many fishermen and boat builders feel offended when told of the possibility of improving existing designs. Their excuse is that fishing boats do not follow the laws of naval architecture, that boats with lower resistance are bad sea boats, etc.,

Norway provides an excellent example of what governments can do. There, the Fisheries Department has had naval architects on its staff for years and has succeeded not only in designing stronger and more seaworthy boats, but also more efficient fisheries tools. The presence of these naval architects has stimulated thinking by fishermen and fishing boat builders and everybody has been made aware of the possiblities of improvement. In Japan, too, a great number of naval architects are attached to the Fisheries Department and a great research staff have their own model tank. Similarly, the

writer has seen books from Russia which indicate that this large fisheries nation clearly recognizes the naval architect as an essential member of a fisheries team. The day should come when it will be as natural to speak of a naval architect as a member of a Fisheries Department in all countries, as it is today to speak of biologists, oceanographers and economists. After all, the boats represent the largest single investment in the fishing industry.

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FAO PLANS FOR A WORLD SURVEY OF LIVING AQUATIC RESOURCES

(*The following article is based upon a statement presented to the* 1954 *Annual Meeting of the International Council for the Exploration of the Sea, by G.L.Kesteven, Chief Biologist, Fisheries Division, FAO, Rome*)

The Fisheries Division has been directed by the FAO Conference to undertake work in connection with a world survey of living aquatic resources [see *FAO Fisheries Bulletin*, VII (1) 22, and the reference to the " Survey of Marine Resources "]. It would probably be agreed that any information accruing from surveys of our renewable resources is valuable, but some further explanation of what is intended by the term ' world survey, ' of how such a survey might be made, and of what part in it should be played by FAO, is perhaps desirable.

I. The International Program for Food and Agriculture in Relation to Fisheries

FAO is concerned with the supply of foodstuffs for the world's growing population, and with the living standard of the people engaged in producing these foodstuffs ; this is the responsibility placed upon the Organization by its Member Governments. Today greater production of food, and other materials derived from animals and plants is demanded. While seeking to fulfill this demand, it is necessary also to consider carefully the effect such increased production will have on the living resources, of how long such extra production might be maintained, and to what extent further increases might be possible. That is to say, world opinion today is that it is not enough merely to produce more now, nor even to ensure that the level of production may be maintained indefinitely, but that, even more, we should try to see how continued expansion can be ensured in the future. And if, in any particular sector of world food economy, it should be shown conclusively that little or no further increase in production may be expected, this is an important conclusion in itself, since it leads to the further conclusion that effort exerted in that sector could be limited and thus waste avoided by diversion elsewhere of effort greater than the limited amount required.

Fishing is a primary industry. In common with all primary industries it consists of a resource, the tools with which the resource is exploited, and the manpower which uses these tools. On the one hand, the production achieved depends in part upon the technical skill and ingenuity with which the tools are produced and used individually, and in part upon the general pattern of operations in the use of those tools. On the other hand, production is determined by the resource itself. However, the pattern of operations shapes itself roughly in accord with the characteristics of the resource, and the efficiency of a particular pattern depends upon the closeness with which it does this. This relation of the pattern of operations with the resource has considerable bearing on our view of the resources survey, as we hope to show.

FAO, being an inter-governmental body, is concerned essentially with government policies and programs. Government programs concerning primary industries fall into two principal categories ; in one the approach is through the existing operations, in the other it is through the resources. Most governments have a program of the first kind ; some also have one of the second kind.

In the first, the government exercises some measures of control and supervision over, and gives some assistance to, the industry. In many countries this program includes conservational practice, protecting the stocks in the interest of the industry and of the country ; in many countries also there is included some program for development by which the industry is encouraged and assisted to expand and improve its operations. The common factor here is the existing industry ; in conservation the problem is whether and how to regulate the indus-

trial operations ; in development, how, and to what degree, and in what direction, to expand them.

The second, and complementary, approach is to consider the resource as a whole and, after examining and describing it, to formulate a general program for exploitation of that resource. This may envisage an entirely new industry to exploit newly revealed resources, but such an approach can apply equally to already exploited resources. In the latter case the more general survey can provide a basis for decisions as to the rational long term development of the industry.

We suggest that a broader view of the resources themselves may furnish a basis for new estimates of the uses which might be made of them. But much remains to be done in this field. At the United Nations Scientific Conference on the Conservation and Utilization of Resources (UNSCCUR) held in 1949, a review was made of what was then known of fisheries resources and of the degree to which they were being used. The specialists gathered there concluded that not only were there important resources which as yet were unexploited, but also there were resources being exploited from which increased production could be obtained.

The two approaches to the problem of using resources manifest themselves strongly in the program of FAO, part of whose work is concerned with promoting and assisting immediate, *ad hoc*, development of primary industries, while another part is concerned with promoting and assisting the evaluation of resources to provide a basis for plans which may concern existing industries or which may relate to the establishment of new industries. Hitherto, the work by the Fisheries Division on evaluation of resources has related to individual countries or to small groups of countries. The present plan of work envisages the same thing on a world scale. We hope for two principal results from this : firstly, certain conclusions in principle concerning the technique of surveying fisheries resources which might apply to individual projects and assist those engaged in such work ; and secondly, a broad summary of what is known about the world's living aquatic resources.

II. The Nature of a Resources Survey

Something further needs to be said about the first hoped for result.

In our view, a survey of living aquatic resources as a project for a limited area involves the following elements :

1. comprehension of the relevant special properties of living resources and of the purpose of a survey as a guide to further human action with respect to these resources ;
2. knowledge of the uses of different kinds of organic products and of the possible means of obtaining them so that the scope of the survey can be narrowed to practicable limits ;
3. knowledge of the types of data needed, the means of obtaining them (equipment, manpower, costs), and the methods for analyzing and evaluating them ;

4. adequate definition of the area to be surveyed and a description of the significant physical and chemical characteristics and the dynamic properties of the water masses ;
5. identification of the significant organisms in the survey area in terms of species, populations and communities, and description of their important static and dynamic properties.

The objective of any survey is to contribute to the understanding of the conditions necessary for successful and sustained exploitation. Achievement of this aim involves reference to technological, economic and social considerations in addition to biological facts. Those concerned with the surveys naturally need some understanding of these other matters.

It will be noted that through the above elements run two principal themes. The first relates to the data on resources and touches upon the methods of making observations, and of recording and compiling these data. The second relates to the theory of living resources and their exploitation, and includes the principles of survey work and the interpretation of the results which come from surveys.

The distinction between a world survey and individual, local surveys can be clearly demonstrated by reference to these two themes. In the first place original observations would not be made in a world survey, which rather is concerned with compiling data and with presenting and interpreting them. But, being designed with a broader outlook, it may indicate new ways in which further observations might be made and the results presented so that they should have the greatest value. Similarly, the world survey would not create a theory of living resources and their exploitation, but would provide opportunities for those who are creating theory to learn about situations other than those with which they are directly concerned and thus to broaden the generalizations they are making.

III. Types of International Action

It is obvious that when the Conference of FAO in its 7th Session approved of the Fisheries Division embarking on work in connection with the survey of living aquatic resources, it did not intend that the Division should itself survey resources, going into the field and contributing in kind to the general accumulation of survey data. Such a procedure is not proper to the Organization. The Fisheries Division has taken this directive to mean that it should encourage and assist Member Governments to carry out the work which is required ; assist in the interpretation of the results obtained, gradually drawing the results together and bringing about an appraisal and interpretation of the results on a regional and subsequently world scale, so that an authoritative statement on living aquatic resources might be prepared.

The three principal techniques which may be employed are :

1. to compile data ;
2. to bring about exchange of ideas by convening meetings etc ;
3. to publish articles or documents on the subject.

The compilations themselves, if carried out with skill, add to the value of the original data and create opportunities for analyses which were not available before. The meetings should secure effective discussion of these data, and out of such discussion should follow agreement as to the further data to be sought ; in addition, the meetings serve to bring about discussion of terminology, method and theory, which is often the starting point for new lines of work in each of these fields.

There is a further technique available to us, namely, to engage specialists in various fields as consultants and, by providing them with special opportunities and facilities, to enable them to undertake work which previously was not being done. When analysis of the compiled data reveals that a particularly well-defined and somewhat restricted sector of our field of enquiry requires immediate study, it may be possible to enable someone with special qualifications to make this study under contract as a consultant. It sometimes happens that the work of a special meeting could be made easier, and its results improved, if some expert on the subject matter of the meeting could make a preliminary review of the status of work in that particular field.

IV. Definition of the World Survey of Living Aquatic Resources and a Plan of Work

Pursuing the above-described lines of thought, the world survey of living aquatic resources is described as follows :

> A program to bring together according to certain agreed principles, all relevant available data concerning living aquatic resources and their environment, with a view to :
>
> (*a*) furnishing a broad conspectus of these resources ;
>
> (*b*) adducing certain conclusions in principle, concerning the theory of the survey and exploitation of resources and the methods to be used, that will apply to individual survey projects and assist those engaged in such work.

The implication of this definition will be clear in the light of the preceding arguments, and it now remains to describe the plan which has been formulated tentatively for the conduct of this survey.

The Division envisages a program of work along two lines corresponding to the double theme mentioned earlier, i.e., there should be one line of work concerned with gathering data, and another with examining theory and method. It is intended that these two lines of activity should be closely integrated so that, in the course of the work, progress in one line should contribute to the development of the other ; we envisage these lines converging upon a world congress, corresponding in some way to the UNSCCUR meeting. We hope that a competent gathering of fisheries scientists would there review and appraise the results of these activities, and that this review would result in a substantial advance upon the conclusions drawn up at the UNSCCUR meeting.

We are consulting the regional fisheries organizations, such as the International Council for the Exploration of the Sea, the International Commission for the Northwest Atlantic Fisheries, the Indo-Pacific Fisheries Council, and the General Fisheries Council for the Mediterranean, as to the plan by which data should be gathered, and seeking their assistance in the task of collecting and interpreting the compilations when completed. We have yet to decide upon the schedule of information which should be gathered, how and by whom the collection should be made, how the data should be reduced and accumulated and how, finally, they should be presented. We have been giving much attention to the bibliographic aspects of this work,* both to the problem of extracting information from the accumulated literature as well as keeping abreast of current work. We have also been considering the classification of our subject matter and the codification of fact, and have examined various forms of maps and diagrams by which we might represent both the state of knowledge on particular matters, and the actual content of the knowledge. Obviously, these compilations must be made according to bio-geographic zones and according to the regions defined by the regional councils and commissions. We are asking each of these bodies — and some have already agreed — to collaborate, as far as lies in their power, at least in guiding the work of compilation according to an agreed plan, and in interpreting the results.

In respect of the second line of activity regarding examining theory and method, our suggestion is that we should convene three principal subject meetings to deal with each of the following subjects:

(*i*) Recruitment and Mortality in Exploited Populations;

(*ii*) The Growth of Useful Organisms and their Productivity;

(*iii*) Production for Human Use by Fishing and Cultivation.

The intention would be that these subject meetings should permit a stocktaking of our theory and practice in each of the major subdivisions (as we see them) of the general theory of fishing

FAO/ETAP INTERNATIONAL TRAINING CENTERS IN FISHERIES[1]

International training centers are a regular and important feature of FAO's Expanded Technical Assistance Program (ETAP), and are regarded as complementary, on the one hand, to the projects promoted by experts in individual countries and, on the other, to the fellowship

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[1] By C. Beever, Economist, FAO Fisheries Division, Rome.
*See *FAO Fisheries Bulletin.* VIII (2), 91-94.

program under which selected candidates from those countries are enabled to study abroad.

The Centers come about as a result of a group of governments expressing their common wish for a particular type of training, sometimes formally through resolutions adopted at regional meetings, sometimes informally through meetings and correspondence between FAO and individual governments. They are, therefore, designed to meet a need which is shared by several governments and one which is characteristic of the area served by the Center.

While this is the basic consideration governing the organization of international training centers, their timing and location depend on a number of administrative and financial factors. FAO cannot meet the full cost of an international training center out of ETAP funds and has to depend on the co-operation of the respective Member Governments concerned.

First of all, it is necessary to find a government prepared to act as "host" to the center. The responsibilities of the "host" government usually include the services of a director, the provision of lecture room and office accommodation, qualified local instructors, and facilities for demonstration in the selected field of training and various administrative services.

The governments who wish to take advantage of the training offered are required to pay for the outward journey of the participants from their home countries to the center ; FAO pays for their return journey, accommodation, travel expenses and subsistence at the center, certain allowances to local instructors, additional teaching staff and various items such as textbooks, documents, films, etc, according to the funds available. While FAO's contribution is fairly large, an FAO/ETAP international training center is essentially a co-operative venture in origin, in organization, and in operation. In this important respect, these centers conform to the principle underlying all other forms of FAO technical assistance, namely, that the requesting governments should provide effective counterpart support in the form of services and, above all, of candidates capable of following up the work on return to their home countries.

I. *Objectives*

In considering the justification for setting up an international training center, the first question is : what problems of immediate and continuing importance will it help to relieve ? Among the many problems with which underdeveloped countries are faced, that of untrained and inexperienced personnel is particularly acute and, as the Technical Assistance Program has developed, more emphasis has had to be placed on the training of those people who will be required to translate sound techinical advice into effective action. Where the need is so great it is difficult to award priorities, but as far as is practicable, FAO has tried to provide a course of training adapted to current developments in the participating countries so that the participants can apply at once the experience gained at the Center.

(a) General Fisheries Courses

(*i*) *First Latin American Fisheries Training Center*[2] (*Valparaiso, Chile*), *6 January to 14 March 1951*

It had been evident for some time that fishery development in many Latin American countries was being hindered by the general weakness of the government fisheries services and by a shortage of capable specialists. The object, therefore, was to assist governments to improve the administration of their fisheries services and further the training of specialists engaged in the fishery industry and research institutions.

(*ii*) *Second Latin American Fisheries Training Center* [3] (*Mexico City, Mexico*), *4 October to 10 December 1954*

While the first center was designed to cover the whole of Latin America, there were a number of countries, especially in the northern part of the region, which were unable to participate. Thus, the second center was intended to complement the first and to cover Central America, the Caribbean, and the northern part of Latin America. At the same time it was intended to continue the training provided at the first center in certain fields, and, in particular, to take advantage of the advanced fishery industry in certain parts of Mexico for the purpose of demonstration and practical training.

(*b*) Specialized Courses

(*i*) *Indo-Pacific Brackish Water Fish Culture Seminar* [4] (*Bogor and Djakarta, Indonesia*), *1 May to 15 June 1952*

The importance of inland fisheries in South East Asia and the Far East is widely recognized since they offer perhaps the most immediate, and often the most practicable, means of increasing fish production, more especially in this region because of the possibility of avoiding certain problems of transport and distribution. However, the problem is essentially one of educating fishermen and fish farmers, and in most countries there are very few people adequately trained for extension work in this particular field. Moreover, there are few places where the necessary training can be provided. In this respect Indonesia offered certain advantages, brackish water fish culture being highly developed there and having been subjected to systematic study over many years. This course was, therefore, designed to train inland fisheries workers from the Indo-Pacific region in fish culture in order to improve the research, development and administration of inland fisheries in the region.

(*ii*) *The Indo-Pacific Fisheries Statistics Training Center* [5] (*Bangkok, Thailand*), *19 June to 31 July 1952*

One of the first problems encountered in fisheries development in the region was the absence of reliable information about the organization,

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[2] See *FAO Fisheries Bulletin* 5 (2), 82-85.
[3] *Ibid.* VIII (2), 98-101.
[4] *Ibid* 5 (5), 201-4.
[5] *Ibid.* 5 (3/4), 154-55.

perations and results of the fisheries industries without which it difficult to plan the most appropriate measures or to judge the efficacy f such measures when applied. The root cause of the situation as the inadequacy of trained staff, and even where statistical training ad been received there was little experience of the rather specialized ethods appropriate to fisheries. The object of the center, therefore, as to train officers of participating governments in various practices mployed in the collection and recording of statistical data necessary or an inventory of the fishery industry and analysis of its results.

(iii) *International Training Center in Fishery Biology*[6] (*Istanbul, Turkey*), *21 September to 27 October 1953*

Fisheries resources in the Eastern Mediterranean and the Black ea concern a number of countries which have not yet developed adequate programs of practical fishery research. The purpose of the enter was to teach methods of fishery research and to show the cope and application of modern fisheries science for certain countries f the Eastern Mediterranean and the Near East.

(iv) *International Fish Marketing Training Centre*[7] (*Hong Kong*), *12 July to 21 August 1954*

While past efforts to promote fisheries development in the Indo-Pacific region consisted mainly of appraising the scope for increasing production and of introducing the skills and equipment required for raising the output of the primary producer, it became evident quite soon that production was limited not only because efficient production techniques were unknown and suitable equipment unavailable, but also because traditional facilities and channels of distribution were inadequate and unsuited to an increased flow of production. The center was designed to instruct the participants in fish marketing methods and organization, to demonstrate, in detail, the workings of the Hong Kong Fish Marketing Organisation, and to provide a groundwork of knowledge which could be applied at once to the resolution of marketing difficulties in countries of the Indo-Pacific region.

In general, the experience in FAO fisheries training centers has been that, owing to the very great gaps in knowledge and experience which need to be filled, there is a tendency to try to achieve too much in any one center, and a danger of confusing specialized technical training with general fisheries education. In the advanced fishing countries, specialists in any one technical field usually acquire a general knowledge and understanding of the fisheries industries merely because they are working alongside these industries and are familiar with their many activities. In the underdeveloped fisheries, however, the gap between a research worker and the fishery industry, for example, is often very wide. There is no common ground on which they can meet, and there are no intermediary workers who, as in the advanced fishing countries, can infuse into the day-to-day operations the experience gained in the labo-

[6] See *FAO Fisheries Bulletin* VII (1), 31-32.
[7] *Ibid.* VII (4), 182-86.

ratory or workshop. In the main, FAO has to recognize two objectives one, to provide an adequate general knowledge of the fisheries primarily for the benefit of fisheries administrators, and the other, to provide intensive technical training for specialized workers in some particular technical field. It is extremely difficult to provide both kinds of training at the same center, and in reviewing the objectives of international training, FAO Fisheries Division now favors a rather strict choice between one or other type of center, with a strong preference for those with clearly defined and carefully limited technical objectives, although it is, of course, necessary to observe the wishes of the requesting governments. All these centers have an additional and important objective to bring together a group of fisheries workers, preferably sharing a similar background, for it is extremely valuable for people engaged in similar work under similar conditions to share their experiences and compare performance, and in this way to foster the idea of practical regional co-operation.

There is the further common objective of making the best possible use of the expert assistance of specialists from the advanced fishing countries during this brief period. Such experts can be spared only for a short time, and training centers provide an opportunity for making the most of their contribution.

Finally, it should be stated emphatically that the purpose of such centers is to provide training which cannot be obtained in any other way. In many places there are few institutions and few text books which could possibly meet the needs.

Generally speaking, and with very few exceptions, the kind of training which FAO tries to undertake should be carried out, as far as possible, under working conditions characteristic of the particular region which the center is intended to serve.

II. Participants

The quality of the participants is perhaps the most important consideration of all those which FAO has to take into account. Whereas a keen group with common interests and experience, and similar economic and educational background, can derive a great deal of benefit even from minimum training facilities, it is almost impossible to serve the interests of an ill-assorted group except at the most generalized and elementary level of training, and certainly in no specialized field. In the preparation of a center, therefore, it is of great importance to define very carefully the type of participants required, and in practice FAO not only does this, but also often assists governments in selecting the most suitable candidates for training. Of course, the governments may find difficulty in providing suitably qualified candidates simply because of their shortage of trained staff and a compromise usually has to be effected, bearing in mind differences of background and training, and providing, as far as possible, for corresponding flexibility in the treatment of the curriculum. In this respect, international training centers in fisheries face the great difficulty that it is almost impossible

to decide finally on the scope and conduct of the training program until the participants are actually assembled, and when their individual characteristics are known to the instructors. Apart from these general problems, there are other factors which have to be considered. For example, the participants may be required to work in a language which is not their mother tongue and in which their proficiency varies. This, naturally, affects the speed and accuracy with the instruction can be assimilated and discussed. Their performance may be influenced by differences of climate, accommodation and diet. They may not all be accustomed to the same working hours, and their performance may vary during the extreme heat of tropical afternoons. Their ages may affect the extent to which they can maintain their interest in, and response to, an intensive training course, especially one involving attendance at numerous lectures.

(a) National Representation

The table on p. 208 shows the national representation at the various FAO fisheries training courses.

It will be noted from the table that national representation varies greatly, reflecting different degrees of governmental interest; also, it must be recognized that there are certain difficulties in finding suitable candidates or paying their fares.

The question of balance is rather important since the predominance of certain countries may tend to obscure the interests of others. In some cases it is FAO's practice to award whatever additional places can be found to the larger countries, and especially to those with provincial fisheries administrations where adequate representation requires more than the two or three places usually offered to each country. Moreover, there is some advantage in obtaining a strong representation from the host country, since the local participants can assist the foreign visitors to settle more quickly and easily into the environment of the center. It is usually preferable for countries to be represented by more than one participant, since the presence of a compatriot reduces any feeling of isolation and consequent lack of self-confidence.

FAO, naturally, tries to achieve uniform representation from as many as possible of the countries served by the center, but some important regional differences may be mentioned. For example, the countries of the Indo-Pacific region are much more separated by language and custom than those of Latin America. At the Valparaiso and Mexico City centers, in spite of the preponderance respectively of Chilean and Mexican participants, the groups were homogeneous in the important matter of language, Spanish being the mother tongue of virtually all the participants. The Indo-Pacific centers, however, have all been conducted in English with some French interpretation, and, for the great majority of the participants, this has meant working in a language which was not their mother tongue, and in which their proficiency has, naturally, varied. The composition of the centers by countries, also, reflects differences of diet and climate.

ATTENDANCE AT FAO TRAINING CENTERS

First Latin American Fisheries Training Center, Chile		Second Latin American Fisheries Training Center, Mexico		Indo-Pacific Brackish Water Fish Culture Seminar, Indonesia		Indo-Pacific Fisheries Statistics Training Center, Thailand		International Training Center in Fishery Biology, Turkey		International Fish Marketing Training Centre, Hong Kong	
Country	Participants	Country	Participants	Country	Participants	Country	Participants	Country	Participants	Country	Participants
Brazil	2	Brazil	1	India	4	Burma	1	Israel	1	Burma	2
Chile	23	Chile	2	Indonesia	5	Cambodia	1	Turkey	15	Ceylon	2
Ecuador	5	Colombia	3	Pakistan	2	Ceylon	1	Yugoslavia	1	Hong Kong	5
El Salvador	2	Costa Rica	2	Philippines	1	France	1			India	6
Paraguay	2	Cuba	1	Taiwan (Formosa)	2	Hong Kong	2			Indonesia	2
Peru	1	Ecuador	2	Thailand	3	India	5			Japan	2
Uruguay	2	El Salvador	1	Viet-Nam	1	Indonesia	3			Malaya	1
		Guatemala	2			Japan	3			Pakistan	3
		Haiti	2			Korea	1			Philippines	2
		Honduras	2			Malaya	5			Thailand	3
		Mexico	21			N. Borneo	1			Viet-Nam	2
		Nicaragua	2			Pakistan	2				
		Panama	3			Philippines	1				
		Puerto Rico	1			Singapore	1				
		Uruguay	1			Taiwan (Formosa)	2				
						Thailand	6				
						Viet-Nam	2				
	37		46		18		38		17		30

GRAND TOTAL 186

b) Qualifications

While national characteristics determine the language and other means of communication between the instructors and the participants, and certain physical arrangements of the center, the qualifications and experience of the participants determine the character of the technical training provided. FAO's experience at various centers has been that, even within the very restricted fisheries services in underdeveloped countries, there are great differences between individuals in the matter of academic and professional training and experience in fisheries work. In spite of the detailed personal histories which candidates are required to submit, it is difficult to judge a candidate's aptitude merely by reference to his academic record or professional status. FAO recognizes that in some work, such as administration, practical experience of the fisheries and certain personal qualities may be much more essential than academic attainments, while in others, such as inland fisheries, fish processing, biological research and so on, inadequate scientific training may be holding back an otherwise first class field worker. FAO's practice, therefore, is to ask for certain minimum qualifications over and above which certain differences are accepted.

In the general fisheries courses an attempt has been made to provide for a wide range of training and experience covering administrators, executives and specialists. For the First Latin American Fisheries Training Center in Santiago, Chile, governments were asked to nominate candidates holding, or destined to hold, responsible positions in the fisheries services, including administrators, field officers, extension and research workers, with education up to at least secondary school level. The group selected comprised graduate biologists, economists, agronomists, educationalists, chemists, engineers, fisheries officers, naval officers, veterinarians, and others. At the Second Latin American Fisheries Training Center in Mexico, the requirements were similar, some preference being given to fisheries workers actually engaged in development programs or projects. Here, the group selected comprised government fisheries officials, biologists, technologists, agronomists, naval officers, co-operative workers, engineers, veterinarians, and others. In fact, the range of qualifications and experience at these two centers is considered to have been too wide for convenience of training, reflecting the anxiety of the governments to participate by whatever possible means, also the different stages of development in the Latin American fisheries.

The problem is simplified slightly in the case of specialized training, but the field of selection is correspondingly limited and, in practice, the availability of suitable candidates has an important bearing on the choice of any particular field of training at any particular time.

The Indo-Pacific Brackish Water Fish Culture Seminar was designed for workers in government inland fisheries services. The emphasis here was on people actually engaged more or less permanently in inland fisheries extension or research, and the absence of academic qualifications was accepted in order to be sure of attracting workers who

would be returning to posts where their training could immediately be applied. It transpired that, in this respect, the participants selected were quite homogeneous.

The Indo-Pacific Fisheries Statistics Training Center was for government officers directly concerned with the collection and recording of fisheries statistical data. Nevertheless, the academic level of the trainees was rather varied, some having high qualifications in fisheries science generally, and in statistical methods, and others having limited formal training in fisheries science and none whatever in statistics, so that the curriculum had to be adapted to cover a wide range of qualifications.

The International Training Center in Fishery Biology (Istanbul), was primarily intended for fisheries biologists of the Near East and Eastern Mediterranean. All the participants, except one, held bachelor or, preferably, science degrees; 12 were directly concerned with fisheries biological research, the others included veterinarians and administrators.

In the case of the International Fish Marketing Training Centre (Hong Kong), Indo-Pacific governments were asked to nominate government officers responsible for marketing or allied services, and preferably associated with fish marketing development projects. The candidates finally selected were all senior officers in the government fisheries services, many of them being deputy directors, or divisional chiefs, and all were responsible in their own governments for work concerned with fish marketing improvements. While their experience of fish marketing varied according to the extent of the government's attention to this problem, the educational level was generally high and quite adequate for the purposes of the course.

The experience gained at these centers has proved most useful in determining the qualifications best suited to particular types of training. Common to them all is the expedient of selecting participants who, it is reasonably certain, will be returning to work on projects where their training will be of immediate use, even at some necessary sacrifice of academic qualifications, especially as the trend in such centers is towards more demonstration and practical work. As FAO extends its acquaintance with the fisheries services in member countries it will be possible to specify desirable qualifications with more confidence and, perhaps, with particular candidates in view.

III. Location of the Center

The choice of a suitable place in which to carry out the training is not always easy, especially in view of FAO's policy to conduct as much of the training as possible in the particular region served by the center. A number of considerations influence this choice, namely:

(*a*) the government of the country concerned must be prepared to act as "host" to the center;

(*b*) there should be adequate lecture rooms, laboratories, workshops, and whatever other accommodation is required for the actual instruction ;

(*c*) there should be suitable accommodation for the housing and feeding of the participants ;

(*d*) there should be adequate facilities for demonstration and practical work, which generally means proximity to fishing centers ;

(*e*) there should be adequate administrative services, e. g. efficient communications, stenographic assistance, office equipment and supplies, transport facilities, and ready access to the government authority concerned with the conduct of the center ;

(*f*) the social amenities should be such as to relax and divert, but not distract the participants ;

(*g*) the center should be readily accessible by international transport services, and located so as to reduce travel costs to a minimum ;

(*h*) finally, it is important that FAO should be in a position to assist in the preparatory arrangements for the center by visits, consultation with the host government, etc., or that the host government can provide competent staff to make such arrangements themselves.

Obviously, such facilities rarely exist in combination, especially in the economically underdeveloped countries, and FAO naturally places emphasis, firstly, on the quality of the available facilities for instruction and, secondly, on the accommodation available to the participants. The First Latin American Fisheries Training Center was conducted in Valparaiso, Chile, where FAO had the use of the technical university with excellent lecture room and laboratory facilities, within easy reach of the fishing and fish marketing installations of the seaport. In addition, the preparation and servicing of the center were considerably facilitated by the convenient proximity of the FAO Regional Office in Santiago, and the friendly relations between the Regional Office and the Chilean Government.

Mexico City, the site of the Second Latin American Fisheries Training Center, was less favorable from a technical point of view owing to its distance from the main fishing centers, though extensive demonstrations were held on both coasts. But it had the advantage of being an international air terminal, conveniently accessible from Central America, the Caribbean and the northern part of Latin America. Unfortunately, it was not possible to accommodate all the participants in the same place, since the university hostels, etc., were full. Classrooms of the mining school were made available for the lectures, and the participants were accommodated individually in various hotels.

The Indo-Pacific Brackish Water Fish Culture Seminar in Indonesia was centered in Bogor, Java — from many points of view an ideal

location since there is, probably, no other area where so many systems of fish culture can be studied at firsthand. Ample laboratory and classroom space were available in various institutes in or near the city, and the experienced Government Inland Fisheries Service was well qualified and equipped to conduct the training program. Hotel accommodation was difficult and scarce, but it was possible to accommodate all the participants satisfactorily, both in Bogor and in small towns in East Java where important demonstrations at pond centers were held.

The Indo-Pacific Fisheries Statistics Training Center was conducted in Bangkok, Thailand, where the Civil Service Administration School was used both for accommodation and instruction. Living accommodation consisted of dormitories with a communal dining room and common rooms ; during field work at fishing centers some distance from Bangkok, the participants were housed in a bungalow and in a house boat. The FAO Regional Office in Bangkok was able to provide many essential services to the center.

The International Training Center in Fishery Biology was held in Istanbul, Turkey, where the Hydrobiological Institute provided full facilities for instruction and demonstration. Since all but two of the participants were Turkish, no special arrangements were required for living accommodation. For the same reason, many of the problems associated with reception, travel, subsistence, etc., were eliminated.

Hong Kong, where the International Fish Marketing Training Centre took place, offered almost unique advantages, in that excellent lecture and living accommodation were offered by the university, and all the main fishing centers, fish markets, etc., were within easy reach daily. The exceptionally well equipped and efficiently administered Government Fish Marketing Organisation was responsible for the direction and the greater part of the training program of the center, which made for particularly smooth working relations with the Hong Kong Government, and prompt satisfaction of all administrative requirements.

The experience gained from these centers has emphasized the importance of early preparatory work to ensure that adequate provision is made for the reception and instruction of the participants, not only on the part of FAO, but also on the part of the host governments. It is not easy to forecast precisely what the requirements will be for each particular center, and in many cases where the host government has had no previous experience of international training centers, it is important that FAO should give, well in advance, as much advice and assistance as possible. In this connection, it is sometimes very difficult for government departments, however willing they may be, to provide, at short notice, all the various requisites, many of which involve unforeseen expenditures. It is well worth the time and effort to prepare, in advance, a minimum inventory of the detailed requirements of the center, including, particularly, such items as sleeping quarters and food, which may easily give rise to discontent among the participants. One other important lesson has been the great advantage of participants sharing common living and eating facilities. Apart from the obvious

advantages of establishing a collegiate atmosphere for the purpose of instruction, it is much easier for a group than for an individual, to accept any discomfort imposed by the needs of the training program as, for example, under camping conditions when in the field. University hostels have proved ideal in this respect. Administratively and financially, too, it is very much easier to deal with a group than with scattered individuals.

IV. Training Program

In drawing up the curriculum certain influential factors need to be taken into account, namely, the qualities of the participants, the availability of instructors, the duration of the course and the facilities available. Logically, the drawing up of a curriculum should be the first task and the choice of instructors, the location of the Center and the duration of the program would all depend on the requirements of that curriculum. This is rarely possible and, while it is customary to draw up the main outlines of the curriculum, it is necessary, in practice, to make a good deal of adjustment to suit the circumstances. For example, the duration may also depend on the funds available, the length of time during which the participants could be expected to remain outside their own countries, and their capacity to sustain a course of intensive instruction. Instructors may be difficult to recruit and again, may be available only for short periods and not always at the most appropriate stage of the program. Preoccupation with the technical subject matter may easily distract attention from other physical and psychological factors. In general, the aim should be to take full advantage of the rare opportunity afforded by these centers for an international group of fisheries workers to come together under the specialized experience of the instructors. This means that there should be considerable emphasis on such personal factors with some sacrifice, if necessary, of purely theoretical instruction, especially where the latter can be provided by some other means, for example, text books, courses at national institutions, and so on.

The First Latin American Fisheries Training Center provided, over a period of three months, a comprehensive course covering fisheries economics and statistics, the technology of fishing and fish utilization, marine and fresh water fisheries biology, accompanied by seminars, discussions and practical laboratory work and commercial demonstration. The timetable required very careful management since the participants were divided into three groups according to their specialized interests but were all required to take part in the general lectures and discussions. In view of the scope of the course, it was inevitable that a great part of the time was devoted to theoretical instruction, in order to be sure of covering the ground.

The Second Latin American Fisheries Training Center, while having similar objectives, provided a rather more modest program of theoretical instruction with much more emphasis on practical work at the east and west coast fishing centers of Veracruz and Mazatlan.

At the Indo-Pacific Brackish Water Fish Culture Seminar, in Indonesia, it was possible to provide a very practical course owing to the outstanding facilities for demonstration. The course lasted for six weeks and comprised lectures on the economic and physical factors controlling fish production in ponds, rice fields and lakes, field demonstrations of the culture of fresh water and brackish water fish, stocking, culture and catching operations in small lakes and reservoirs, and the organization of extension services. The time was divided fairly evenly between theoretical and practical work — a very desirable balance from the point of view of maintaining interest, which also provided an excellent opportunity for the exchange of ideas among workers with similar interests.

The Indo-Pacific Fisheries Statistics Training Center provides a good example of the adjustments which may be necessitated in the training program. Following an initial examination of the participants' qualifications, it was necessary to make considerable changes in the original plan and to concentrate on a less ambitious course, covering the following points : description of the fisheries industries, design of questionnaries, record sheets, instruction to collectors, practical techniques of field collection, planning of a program of statistical collection. The varying qualifications of the participants made it necessary to reduce the number of lectures substantially, and to devote much more attention to practical work. After practical instruction in the use of certain techniques, design of forms, etc., the participants were sent to fishing villages, to carry out practical exercises in statistical collection, with some emphasis on sampling. The results of this work were then analyzed in the class room.

The Training Center in Fishery Biology in Turkey lasted for six weeks and provided a mainly theoretical course dealing with fisheries biology and oceanography with a certain amount of laboratory work and field trips. A feature of this course was that all lectures, where necessary, were translated into Turkish and English.

The program for the International Fish Marketing Training Centre, Hong Kong, comprised a series of lectures covering fish marketing economics, organization and practice, a detailed demonstration of the management and the operations of the Government Fish Marketing Organisation, and seminars based on reports prepared by the participants. An even balance was struck between lectures and practical work, the two being alternated as far as possible to maintain interest.

In general, there has been a fairly steady development in the planning of these centers towards a pattern of training in which theoretical instruction, practical work and demonstration and seminars are carefully balanced. For the same reason, there has been a healthy tendency to limit the subject matter more strictly with the emphasis on a few salient lessons throughly understood and clearly illustrated and on a more active contribution by the participants themselves. It has been found that practical work greatly increases the confidence of the participants, and the opportunity of discussing their own ideas and exper-

nce with each other, as well as with a critical and experienced group instructors, has proved most beneficial. This method also provides very much better means of testing the progress made by the participants than formal tests, necessarily brief, at the end of the training. Where differences of language and academic training prevail, it is virtually impossible to judge the performance of the participants under equal conditions in a written examination.

The problem of communication between the instructors and the participants is an over-riding consideration and FAO's practice in nearly all these cases has been to reproduce the text or summary of lectures before actual delivery so that the participants can assimilate the subject matter thoroughly and discuss it with assurance. As far as possible, lectures and demonstrations have been followed up by informal explanation and discussion with individuals or small groups.

7. Instructors

Reference has already been made to the problem of finding qualified instructors and the bearing which this has on the program of training provided. From FAO's point of view, they may conveniently be considered in three main groups.

(*a*) *Instructors provided by the host government.* The number and qualifications of these have varied considerably, but it is generally true that the centers which have the best prospects of success are those where there is an experienced team of local personnel, thoroughly acquainted with both the technical subject matter and the local conditions prevailing in the participating countries. This is especially true with demonstrations and field work and other practical activities. Perhaps one of the most useful exercises which a center can provide is that of taking the participants, stage by stage, through some particular operation in the fisheries under the guidance of the man "on the spot" whose advice will carry the conviction of one doing his own job confidently and efficiently.

(*b*) *FAO permanent staff.* This group includes the Associate Director, who should serve as very valuable link between a local instructors, the participants and the visiting instructors. They are, possibly, the only people at the center who know something about all three groups and who are, therefore, able to ensure that the best possible use is made of the experience of the other instructors, and that the latter are familiarized with the needs of the participants. Ideally, they should be attached to the center for the entire duration, since they perform a most valuable function in attending to the needs of the participants, formally and informally, during and after the normal hours of instruction. Other instructors may, of course, perform the same services, but in the first place

the initiative rests with the FAO staff to get the participants together, to keep them working harmoniously as a group, and to convince them of their own potentialities and the desirability of the training provided.

(c) *Visiting instructors engaged by FAO for specific duties at the center.* These are normally people of international repute with specialized experience of the latest developments in a particular field of fisheries work. While it is true that it is extremely difficult to find people who combine such experience with adequate knowledge of the fisheries of underdeveloped countries, it is easier to obtain their services for training centers, owing to their relatively short duration, than for other technical assistance projects. They can make a considerable contribution to the training and, from FAO's point of view, be additionally valuable because the representatives of so many different countries can enjoy the advantage of this experience simultaneously. It is, however, an expensive matter to engage senior government or commercial fisheries personnel, especially from countries far distant from the center. FAO's responsibility here is to ensure that such instructors are adequately briefed on the regional fisheries problems which they will help to resolve, also that the timetable is so arranged that full advantage can be taken of their attendance at the center.

Clearly the three groups need to be considered in combination, and the composition of the teaching staff of the FAO centers has varied fairly considerably according to the extent to which FAO has had to make up for the lack of qualified local instructors. The following shows the composition of the teaching staff at the various FAO centers :

First Latin American Fisheries Training Center, Chile

Host Government	2
United Nations	2
FAO : Regular staff	3
Visiting lecturers	11

Second Latin American Fisheries Training Center, Mexico

Host Government	7
FAO : Regular staff	3
FAO/ETAP experts in the country	2
Visiting lecturers	7

Indo-Pacific Brackish Water Fish Culture Seminar, Indonesia

Host Government	8
FAO : Regular staff	1

Indo-Pacific Statistics Training Center, Thailand

Host Government	nil
FAO: Regular staff	2
Regional lecturers	3
Single Lecturers: ECAFE	2
U.S.TCA	1
FAO	1

International Training Center in Fishery Biology, Turkey

Host Government	5
FAO: FAO/ETAP experts in country	5
Visiting lecturers	2
Locally engaged	1

International Fish Marketing Centre, Hong Kong

Host Government	11
FAO: Regular staff	3
Locally engaged	3

This list excludes guest speakers who, on various occasions, were invited to address classes. In each case FAO staff includes the Associate Director of the center but exludes any administrative staff provided. It is not possible to indicate in such a list the many local people who have been able to assist the training during demonstration periods and practical work in fishing centers, laboratories, fish markets, etc., but their valuable contribution should not be overlooked when reviewing the adequacy of the teaching staff. The length of time spent by individual lecturers at the respective centers has varied a great deal, but obviously has been shortened in the case of lecturers recruited from abroad. That is one reason why it is desirable to achieve a fairly even balance between those who can serve the center throughout its duration, and those who can be available for only a short time. The value of introducing variety by means of different lecturers with different experience has to be weighed against the danger of disturbing the continuity of the training, or of sacrificing the time required to establish friendly working relations between the instructors and the participants. The number of lecturers required will vary according to the technical subject matter, but should at least be adequate to ensure that individual lecturers are not unduly over-burdened. In some cases the associate directors themselves carried a large part of the burden of instruction in addition to their other onerous administrative responsibilities. By contrast, there have been occasions when lecturers have been recruited at rather high cost from abroad to deliver relatively few lectures. The composition of the teaching staff, therefore, is a matter which requires early and careful thought during the preparation of a Center, and again the aim should be to ensure adequate coverage of the particular technical field by a team which is not too large or too changeable, to permit the instructors and participants to become thoroughly acquainted with each other.

VI. Usefulness of Fishery Training Centers

While it is impossible as yet to make any final evaluation of the usefulness of the training provided, or to foresee so soon the long-term results which largely depend on the government policies and the pace at which they are implemented, certain advantages arising out of the centers can be appreciated at once and of themselves would appear to justify the promotion of this form of technical assistance — especially where the training is directed towards limited, clearly defined technical objectives :

(*a*) The bringing together of a regional group of similar status and occupation, working alongside a competent group of instructors is a useful achievement in itself. The fact that in most countries fisheries workers find themselves virtually isolated professionally and often geographically, and belong to a small minority of people concerned with fisheries whose expert advice is frequently ignored in higher councils, tends to engender a feeling of frustration. Experience at FAO centers has shown that contact with a group sharing similar training and experience has proved most stimulating, and has helped to revive the participants' interest and faith in the value of their work. This psychological condition has heightened the response to, and therefore increased the value of, the training undertaken.

(*b*) The communal or rather collegiate atmosphere of the centers has established a noticeable *esprit de corps*, which has facilitated the exchange of ideas and information about the participants' own work and experience, and has promoted mutual understanding of problems characteristic of the respective countries. For example, the participants at the International Fish Marketing Training Centre, Hong Kong, quite spontaneously formed themselves into a group known as the Indo-Pacific Fish Marketing Association for the purpose of continuing the exchange of information and experience after returning to their own countries. A similar association was formed by the participants of the Second Latin American Fisheries Training Center in Mexico City. Obviously this kind of international concord has a value which transcends that of the purely technical instruction acquired.

(*c*) In general, the participants have responded very eagerly to the opportunity for carrying out practical work under skilled guidance. In many cases this is precisely the kind of experience which they lack, in the absence of a highly developed fishery organization in their own countries ; the opportunity of seeing for themselves and, if possible, taking part in certain essential operations, provides the best guarantee that they will translate technical training into effective action in their own countries.

(*d*) Most instructors have observed that the quality of the participants' work has improved during the course of training, and in particular that their outlook on fisheries problems has broadened owing to the many new but important factors revealed by the instruction and by discussion.

(*e*) It has also been observed that the participants, after an understandable period of diffidence during the early days of a center, have gradually developed much more confidence in themselves and in their work, especially after submitting and discussing their views before a critical group.

(*f*) The participants have learned and understood a great deal more about the objectives and methods of FAO, a factor which is bound to contribute to the success of FAO's technical assistance projects in the respective countries.

(*g*) The host governments concerned have acquired a closer knowledge and understanding not only of FAO's activities but also of the needs in the participating countries.

(*h*) FAO has learned a great deal from the centers, and is in a much better position to evaluate the requirements of the participating governments, to understand local conditions and to secure local counterpart help for its projects. Centers have also enabled FAO staff to build up a wide acquaintance with key fisheries personnel, through whom continual information and advice can be transmitted.

(*i*) Some recent developments can be associated directly with particular centers :

(*i*) There has been steadily growing emphasis on inland fishery development in South and East Asia. All the participants at the Indo-Pacific Brackish Water Fish Culture Seminar are now working as extension or research officers, and reports of the successful application of techniques demonstrated during training, have been received. There has been a steady demand for more training of that type, and an increasing number of requests for technical assistance in inland fisheries.

(*ii*) It is less easy to hasten the development of statistical services, but FAO reports indicate much more attention to this problem in most of the countries represented at the Indo-Pacific Fisheries Training Center.

(*iii*) Many participants at the First Latin American Fisheries Training Center now hold responsible posts in government fisheries services in Latin America. Requests for technical assistance have increased, covering many countries where fisheries had long been neglected.

(iv) One immediate effect of the Second Latin American Fisheries Training Center was the enthusiastic assistance given to the FAO/ETAP fishery expert in Mexico by the Mexican participants. At least three trainees from the center have been designated by their respective countries — Honduras, Nicaragua and Costa Rica — to organize a fisheries section within the Ministry of Agriculture.

(v) The Turkish Government has recently set up a new Fishery Biological Research Center, largely staffed by participants from the International Training Center in Fishery Biology, Istanbul.

(vi) Several countries represented at the International Fish Marketing Training Centre, Hong Kong, have reported their proposals for fish marketing development, and there has been a sudden increase in the number of requests for technical assistance in this field.

Finally, it must again be stressed that FAO training centers in fisheries should not be regarded as alternative to technical assistance projects in individual countries or to fellowship training abroad, but rather as closely complementary and necessary to them. FAO's experience of technical assistance in fisheries, where local workers are so few, has shown that effective counterpart support is vital to the success of any project. It is the local people who are the "experts" on their own conditions and, in the long run, they have the best if not the only chance of applying good technical advice in their own fisheries. Good fishery workers are notoriously scarce and training centers provide a means of building up a nucleus of local personnel, educationally and psychologically equipped to absorb and apply such expert advice. Furthermore, there is the other and important consideration that the training provided will be reflected in more realistic requests for FAO's help under its regular and expanded technical assistance programs.

VII. Future Training Needs

There is, of course, a very wide scope still for further international training on a regional basis, and FAO will continue to promote such centers as and when funds and facilities are available. In Latin America the general courses already provided will need to be followed up by more specialized technical training, especially in fish processing technology and distribution. In the Near East and Mediterranean, where some countries have no properly constituted fisheries services, some groundwork in fishery administration will have to be provided very soon to ensure adequate support for the considerable technical assistance required by these countries. In Asia and the Far East, where fisheries services in general are relatively more experienced and better established, specialized technical training will have to be continued in

te matter of inland fisheries, statistics and fish marketing manage-lent, and also extended to cover co-operative organization, processing chnology, boat and gear technology, and possibly biological research ethods. There are indications that some countries, such as India, e now interested in conducting their own national training centers fisheries, a healthy indication of the growing concern for the prelimi-ary and in-service training of fisheries workers. Other governments in ountries with highly developed fisheries industries and services have also own more interest recently in the possibilities of international training.

FAO is most anxious to encourage such interest, and to engage ne support of Member Governments in finding the best instructors and uitable training facilities. Suggestions in this respect will be welcomed nd it is hoped that, eventually, these training centers will be recog-ized as a realistic and convenient means of bringing the specialists ngaged in the world's most advanced fisheries into closer touch with wide circle of their less experienced counterparts in the underde-eloped fisheries. There is much mutual benefit to be gained from the rowing number of people who thus acquire an understanding of the ractical ways and means of bringing about a world-wide increase in ne production and consumption of fish products.

Conferences and Meetings

International Whaling Commission *

At the invitation of the Government of the U.S.S.R., the Inter-ational Whaling Commission held its 7th Annual Meeting in Moscow, rom 18 to 24 July, 1955.

The first plenary session was opened by the Minister of the Fishing ndustries, Mr. A. A. Ishkov. He warmly welcomed the delegates, ongratulated the Commission on the work it was doing to preserve he whale stocks, and indicated the determination of the U.S.S.R. lso to co-operate to that end.

All the 17 contracting governments, with the exception of Brazil, vere represented, namely: Australia, Canada, Denmark, France, celand, Japan, Mexico, the Netherlands, New Zealand, Norway, Panama, Sweden, the Union of South Africa, the United Kingdom, he U.S.A., and the U.S.S.R. Italy and the Argentine were represented by observers, as were also the Association of Whaling Companies, the nternational Council for the Exploration of the Sea, and FAO. The U.S.S.R. delegation was headed by academician E. N. Pavlosky.

Tribute was paid to Dr. Remington Kellogg (U.S.A.) at the end of his three-year term of office as chairman. He was succeeded by Dr. G. J. Leinesch (Netherlands) for the next three years; Mr. R.G.R. Wall (U.K.) was elected vice-chairman, the position vacated by Dr. Leinesch.

* See *FAO Fisheries Bulletin*, VII (4), 178-79.

The Commission considered its agenda through the medium of two committees – the Technical Committee, under the chairmanship of Mr. Wall, and the Scientific Committee, under the chairmanship of Dr. M.A. Mackintosh. The reports of these committees were considered by the Plenary Session of the Conference, the most important result being the adoption of the following amendments to the schedule attached to the 1946 Convention, containing the whaling regulations:

1. *that* the 15,500 blue whale units limit now in operation shall be reduced by 500 for the season 1955/56, and thereafter by a further 500, bringing the total units to 14,500.

2. *that* no blue whales should be taken before 1 February in each year, instead of 21 January now in force with a view to protecting the blue whale stock in the Antarctic.

3. *that*, for a period of three years, certain previously closed areas in the Pacific sector, should be re-opened. This area is roughly south of 40° S. Lat. from 70° W. Long. westward as far as 160° W. Long. One object of this measure is to enable the stock of whales there to be studied.

When making these amendments, the Commission considered even further protection of the blue whale was necessary and that the season for killing them should be shortened. However, it was felt that this would lead to more fin whales being taken, the stocks of which, in some places, were already in danger of being overfished.

These decisions were not all unanimous, and it is important to realize that none of these amendments to the schedule can come into operation until they have been submitted to all contracting governments, who have the right to object within a period of 90 days. If any objections are received within that period, a further 90 days must elapse before the amendments can come into operation; even then they are not binding to those contracting governments who have objected.

The Commission further decided to ask the depository government, the U.S.A., to proceed with the amendment of the 1946 Convention by means of a protocol so that helicopters and other aircraft could be brought within the jurisdiction of the Convention. It was also decided to deal in the same way with the question of inspection, which cannot be dealt with by an amendment of the schedule.

This action was taken in connection with a proposal put forward by the Norwegian Commissioner to put on board each factory ship an observer of different nationality from the flag of the ship in addition to the existing inspectors required under the Convention.

An examination was made of the returns, which had as usual been rendered in the matter of infractions of whaling regulations, and the Commission was glad to observe that these were fewer during the last year than in the previous one; but the number of lost whales was regrettably higher than in the previous year. Certain decisions were taken to improve the form of the returns used in recording the catches.

The Bureau of International Whaling Statistics at Sandefjord, rway, which acts as the statistical arm of the Commission, presented catch figures for the past season, which lasted until 19 March 1955. neteen factory ships with 233 catchers were engaged. The total output from the Antarctic increased from 2,057,479 barrels in the 53 season, to 2,237,560 barrels, inclusive of sperm oil, for the 1954 son. Outside the Antarctic the output was about 600,000 barrels, compared with 450,654 barrels in 1953.

The Commission decided to intensify its efforts at whale marking d, as later indicated, set aside £1,000 (U.S. $2,800) for that purpose its budget for the current year. Whale marking affords invaluable ta on the length of life and precise migratory routes of the whales.

The amendment to the schedule, proposed in 1953, prohibiting the tching of blue whales in the North Atlantic and the North Pacific r a period of five years, but to which the Danish and Icelandic overnments registered objection within the prescribed period, was scinded.

In the region of administration, the Commission approved a statent of expenditure for the year ending 31 May 1955, the operation ving cost for that year the sum of £2,271 (U.S. $6,359). For the rrent year, due to end 31 May 1956, the Commission's expenditure s estimated at £3,500 (U.S. $9,800) which includes a special m of £1,000 for whale marking and other scientific work. The ntribution to be requested of contracting governments remains at 50 (U.S.$420) per annum. The Commission made certain alterations its standing orders, which will now provide for two annual meetings t of every three to be held in London, where the Commission's office situated. It was also decided that the Scientific Committee should ain meet to consider certain scientific problems in anticipation of the 956 annual meeting, which the Commission decided to hold in London.

The Commission was very emphatic in its appreciation of all the rangements made by the U.S.S.R. for the success of the conference, d expressed its gratitude to the Government and its delegation.

ternational Seaweed Symposium

The 2nd International Seaweed Symposium was held in Trondeim, Norway, from 14 to 17 July 1955, under the presidency of rof. T. Braarud (Norway). The Symposium, organized by the Norwegian nstitute of Seaweed Research, Trondheim, was attended by delegates om 20 countries.

The purpose of the meeting was to give scientists and manufacturers n opportunity of exchanging information and discussing the present osition of seaweed research and exploitation. The papers presented ere based on these two topics.

The discussions were arranged under the following headings:

1. *Chemical composition of seaweeds.* The speakers reported on the low molecular carbohydrates, polysaccherids, vitamins, antibiotics and pigments present in the algae.

2. *Practical usage of algae products.* The use of the Macrocystis source of trace elements in human nutrition, seaweed for stock feeding, and experiments with seaweed meals as supplements to rations for chicks and laying hens, were among the subjects discussed. The papers showed that there was need for more precise experiments, particularly regarding nutrition.

3. *Methods for analyses and exploitation.* Lectures were given on detection of alginic acid and other seaweed components and methods of drying seaweeds.

4. *Microbiology.* The influence of microorganisms on seaweeds and their products was discussed.

5. *Botanical studies of seaweeds.* Papers submitted covered the biology and distribution of seaweeds of economic importance, and a plan for a cartographic survey of the marine algae used in industry.

At the closing session, Prof. G. Young (Canada), proposed that the 3rd International Seaweed Symposium be held in Canada.

Fisheries Division Activities

Program of Work – Economics and Statistics Branch

General

The Economics and Statistics Branch, as its name indicates, concerns itself with aspects of the fisheries to which economic and statistical methods can be applied, but its responsibilities extend beyond to administrative, institutional and social aspects in general.

From this extemely wide field, only a few subjects can be selected for attention and are incorporated in FAO's Program of Work, which is drawn up biennially for review and approval by the Conference of FAO [for 7th Conference, see *FAO Fisheries Bulletin*, VII (1) : 23]. Preference is given to subjects which are both important in themselves and specially suited to an *international* approach. The emphasis is, accordingly, on the provision of *internationally* comparable statistics, (including the development of internationally acceptable classifications and methods) on the one side, and on the collection and dissemination of information about economic and related aspects of the fisheries which are of particular international interest on the other.

The *FAO Yearbook of Fishery Statistics* embodies much of the rk carried out by the Branch in the statistical field. Published the first time in 1948, it is now issued in two parts in alternate ars. The first part contains statistics on catch and landings, utiliz- ion (disposition), production of preserved and processed commodities, d fishing craft, while the second gives details on imports and ports of fisheries products. The tables are compiled from national tistical publications and from figures supplied by governments in sponse to questionnaires and enquiries. The Bureau of International haling Statistics co-operates in respect of whaling data. The Year- ook is destined for government, industry and academic agencies ncerned with fisheries.

The aim of the Yearbook is not to be a substitute for national tistical publications, but to group and present national data in such fashion as to make global and regional analyses possible, to provide comprehensive background against which national fisheries statistics n be viewed, and to facilitate international comparisons.

This aim can only be achieved step by step. Compilation of lorld-wide fisheries statistics is a recent venture, and the necessary chniques and standards are being developed gradually. To assist is development, the Branch has, from an early date, promoted the provement of national statistical services, as far as fisheries are ncerned, and has helped in the standardization of concepts and terms the interests of international comparability. Some of this work as done in co-operation with other international agencies concerned ith larger segments of international statistics, particularly in connec- on with the United Nations Statistical Commission and the Statis- cal office of the United Nations. As a result, the treatment of fisheries roducts in international trade statistics, to give an example, has been nsiderably clarified.

An important contribution to the definition of purposes and the velopment of methods in fisheries statistics was made by the First nternational Meeting on Fisheries Statistics, organized by FAO and eld in Copenhagen, Denmark, in 1952 [1]. A comprehensive report on he Meeting, based on the papers contributed to it and on the discus- ions which took place, will shortly be issued.

The Program of Work for the Branch provides not only for the ontinued compilation and publication of the Yearbook, but also looks owards further improvement both as regards its coverage and present- tion. It is hoped that some useful indices of fish production and trade or the world as a whole, and for certain regions, can be developed, hat representative price series can be added and that, eventually, the tatistics on fishing craft might be improved and supplemented by gures on gear and manpower employed. It is also intended to com- ile further summary tables and to calculate more regional and cont- nental figures making use, where necessary, of provisional information

[1] See *FAO Fisheries Bulletin*. 5 (3/4), 151-54.

and of estimates. In the intervals between successive issues of the production part of the Yearbook (at present planned on a biennial basis), interim statistics of landings for the principal fishing countries of the world are to be published. Such an interim publication, covering 1954, is to appear this year. A bibliography of the statistical sources for the Yearbook is also in preparation.

To carry international standardization further, the Branch is preparing a provisional FAO Fishery Commodity Classification, with definitions, as a basis for discussion among member countries.

Study methods of collecting, compiling and presenting fisheries statistics continues in the Branch, and is linked with work both under the Regular Program, and in support of the Expanded Technical Assistance Program (ETAP). Lectures (in Spanish) on the elements of statistics as applied to fisheries, prepared for delivery at an ETAP training center, have been issued in book form for more general use, and a handbook (in English) on fisheries statistics for the Indo-Pacific Fisheries Council is in preparation.

Economics

As far as economics and related aspects of the fisheries are concerned, the work of the Branch is still at a rudimentary stage. Unlike most other industries, fisheries have received very little attention from workers in the economic field. Such work as has been done is scattered, confined to particular problems of particular fisheries and much of it, having been done in government offices or industrial organizations, has remained unpublished. At the same time, the economic problems of the fisheries have lately become very prominent.

It is increasingly recognized that the expansion and improvement of the fisheries industries of underdeveloped countries is limited not only by lack of technical knowledge and skill, but very largely by economic and social factors such as lack of capital, monopolistic structures and inadequacy of government services. There is, therefore, an urgent need for the systematic study of the role of these factors in fisheries industries so that their modification may be rationally planned and put into effect.

Even in the more highly developed fishing countries the lack of adequate knowledge and understanding of economic factors is being felt increasingly. In their national spheres, governments are trying to assist their fisheries industries by various direct means, such as subsidies, credit facilities, price support and marketing schemes, and indirectly through provision of information and advice. These endeavors can be furthered by improvements in the tools and methods used in analyzing the economic and related aspects of their own industries and by more knowledge of the experience gained with similar problems in other countries. This applies particularly to government services of all kinds, price equalization and maintenance schemes, co-operatives and other forms of industrial organization and market improvement schemes. Also, in the more highly developed countries, much attention has lately been directed to the problems of rational exploitation of internation-

y accessible fishing grounds. These problems have, in the past, en considered mainly in their biological and legal aspects, but recent cussion shows that the economic aspects — so far yet poorly un- rstood — are also of decisive importance. The application of the nciples of production and welfare economics to the problems of ternational fisheries, which in some respects are quite unique among responding problems in other industries, is therefore called for.

An international organization such as FAO is expected to provide obal and regional appraisals of activities within its terms of reference. d its Fisheries Economics and Statistics Branch has to discharge is responsibility in respect of economic appraisals of world and region- fisheries as, for instance, for incorporation in its annual public- ion, *State of Food and Agriculture*, in working papers for regional d other conferences, and in special publications. The adequate rformance of this function requires the comprehensive and systematic llection and analysis of information on a world scale, on the economic pects of catching, processing and marketing fish. However, the sources of the Branch and the information regularly available are as t far from sufficient for this task. Systematic work has been confined commodity studies on salted cod and on herring and to substantial rticipation in a comprehensive survey of fish marketing in Europe. her appraisals have to be based on incidentally collected information th the result that they are limited both in quantity and quality.

For the same reason, the contribution of the Branch to work on onomic and related aspects of the fisheries in general must largely made indirectly by promoting efforts in this field by individuals d institutions. In this connection, work primarily undertaken as a rt of the Expanded Technical Assistance Program can be made more nerally available and useful. For instance, lectures prepared for aining centers can be issued in book form, as has been done with ose on economic and related subjects given at the First Latin Amer- an Fisheries Training Center[2]. A recent training center on fish market- g in the Indo-Pacific region[3] provided material from which accounts ve been prepared on the fish marketing problems of a number of untries in the region, and of the Hong Kong Fish Marketing Organ- ation, an outstanding example of successful development in that rt of the world. A forthcoming training center on inland fisher- s, to be held in Indonesia, will provide an opportunity for applying e methods of farm management economics to inland fisheries, and is expected that a useful text on the subject will result. The expe- ence gained in the solution of specific problems encountered by experts ssigned to individual technical assistance projects can be used to uild up a body of knowledge about economics of fishery development nd marketing.

The comparatively underdeveloped state of fisheries in many untries, in relation to other industries and agriculture, is attributed a considerable extent to the absence or weakness of institutions and

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See *FAO Fisheries Bulletin*, VII (3), 130.
Ibid. VII (4), 182-89.

organizations which could provide the services and facilities necessar for development to a more advanced level. Many governments ar planning or implementing improvements in this field. In order t allow one government to profit from the experience of others, the Branch is also promoting the compilation of a number of pilot studies o institutions and services in fishery production and marketing. These studies will not only provide information on important examples i this field, which will be of interest to people in other countries with similar problems, but should also serve as prototypes for analogou studies that it is hoped will be undertaken elsewhere. These will in turn, provide the basis for a more comprehensive comparative analysis of the institutions and services described. So far, studies on government services to the sea fish industry of Great Britain, on the re-organization of fish marketing in Germany, and on fishermen's organizations and the regulation of fish prices in Sweden, have been commissioned. Further pilot studies are to be initiated over the next few years.

In the field of basic fisheries economics, progress ultimately depends on the extent to which the creative work of economists can be directed towards the problems of the fishery industries. The number of those qualified and interested is still small, and opportunities for the interchange of information and thought among them too limited. The Branch is endeavoring to improve its contacts with the workers already in the field, with others who might be interested, and with institutions where such work is being or could be carried out. It will assist with the exchange of ideas and information on work performed and in progress. It also hopes to promote directly some fundamental preparatory work, for instance, on bibliographies.

The more empirical studies of fisheries economics, such as on those fishermen's incomes and expenditure undertaken in a number of countries, can benefit from progress in theoretical work, also from a wider exchange of information about methods used and results obtained. The Branch is taking steps to assist here also.

An account of the Program of Work of the Economics and Statistics Branch would be very incomplete without mention of the extensive responsibilities it shares with the other branches in the direction and administration of the Expanded Technical Assistance Program. The appraisal of projects, recruitment and briefing of experts, technical direction of their activities, review and evaluation of their reports and recommendations, programming and supervision of fellowships, organization of training centers and the like, in fact absorb a very large proportion of the resources of the Branch, though they do not call for detailed description here.

Personnel

Dr. William Forsey Hampton (U.S.A.), joined the Technology Branch of the Fisheries Division on 25 September, 1955, as Chief of the Fish Processing Section.

Dr. Hampton is a graduate in chemistry and physical chemistry the Canadian Universities of Dalhousie, Halifax, and McGill, Mont-l. From 1935 until 1943, he worked as chemist, Chief Chemist, ll then as Acting Director, of the Fisheries Research Laboratories, partment of Natural Resources, St. John's, Newfoundland. He then hed the Seafoods Division of the General Food Corporation, Boston, ss., U.S.A., as Director of Research and Development. On leaving Corporation in 1951, he became Manager of the Birdseye Fisheries noratories in White Plains, New York, and held this post for four years. Dr. Hampton is a member of the American Chemical Society and American Association for the Advancement of Science. Among his tings are the *Organization of a Quality Program*, and *The Role of chnology in the Fishing Industry*.

panded Technical Assistance Program

Resumé of progress in fisheries.

Brazil. W. E. Ripley (U.S.A.), marine fishery biologist, with team of Brazilian co-workers, is assembling catch data, later to be corporated into a series of charts to demonstrate the distribution d relative abundance of certain commercially dominant species of h. Robert E. Lee (U.S.A.), fishery engineer, has carried out a eliminary survey in the Recife area in preparation for a program of perimental fishing which started in September, in a vessel to be ovided by the Government.

Dr. S.A. Beatty (Canada), fish processing technologist, assumed uty in Brazil in August after a stop at the Santiago, Chile, FAO egional Office for further briefing. He also stopped over in Panama ee p. 233). He will study in Brazil the present conditions in the istribution and fish handling phases of the industry, and will deter-ine which problems in those fields require further investigation which n be undertaken in the federal, state or university institutes. He ill then advise on the organization of this research, and on the rvices necessary for putting research results into general application.

Dr. C. A. Torres Botelho (Portugal), fish processing technologist, ssumed duty on Belem on 22 June and is carrying out a preliminary rvey of conditions in the fish dry-salting industry in the Amazon gion, and the problems of transport and of marketing the finished roduct. A fishery economist is also being recruited to advise the uperintendency for the Development of the Amazon region on its shery development program and the structure of its fishery admin-tration.

Burma. J.Alan Tubb (Australia), inland fishery biologist, assumed uty in Rangoon in August. He will carry out a general survey f the existing fisheries in the inland waters and advise on develop-ent possibilities.

Ceylon. Einar Kvaran (Iceland), marine engineer, has prepared an interim report on his mission, and for the next few months will be co-operating closely with officers of the Canadian Colombo Plan Organization in Ceylon in establishing workshop facilities at the fish wharf being built from Colombo Plan funds, where modernized fishing craft can be adequately serviced and maintained, and where training can be given in marine engine maintenance and motor-minding.

J. Saemundsson (Iceland), fishery engineer, has made up a two-boat trawl for the bottom fishing work and some nets for inland fishery work. A purse seine for surface fishing is also being made up from materials available locally, and a program of experimental fishing with purse seine and two-boat trawl from small craft will soon be under way.

Dr. S. W. Ling (China), inland fishery biologist, has made some preliminary observations on the local occurrence of chanos (milk fish) and, as a preliminary experiment, has collected from the sea and stocked into tanks about 6,500 fry. He has also launched a training program for local fisheries officers: nine have already completed a short intensive course. Further experimental work on Trichogaster (*Sepat siam*) and other fish is being laid out.

Chile. Charles Olesen (Denmark), master fisherman, is being furnished by FAO with additional line-haulers so as to develop his long-lining program in deep water, and he is also working with nylon bottom-set gill nets and trolling with artificial lures.

N. P. Hansen (Denmark), fish handling technologist, has not only continued his demonstrations of improved cold and hot smoking of fish, but has also assisted local enterprises in improving the quality of their fresh fillets and iced fish by better organization and by mechanizing some of the operations, such as washing. His advice is highly appreciated by local fish handling enterprises.

A fish marketing economist is being recruited to carry out a general survey of the marketing in the fishery industry.

Prof. J.N. Bahamonde, FAO/ETAP Fellow in marine fishery biology has completed his course of study at the Norwegian Institute of Fishery and Marine Research at Bergen and will be paying shorter visits to Sweden and Denmark before returning to Chile.

Colombia. Dr. V. Paz-Andrade (Spain), fishery economist, completed his field mission and returned to Spain in July. His report is in preparation.

Costa Rica. Martin Burkenroad (U.S.A.), shrimp biologist, visited Costa Rica from Panama in August in preparation for a longer assignment there in 1956. He also completed arrangements for the appointment of a Fellow from Costa Rica to work with him in the Panamanian Government's Laboratory for Shrimp Investigations.

Curação (*Netherlands Antilles*). T. W. Burdon (U.K.), fishery consultant, has prepared a report on his two weeks' reconnaissance survey of the fisheries situation which he carried out in July. This

erim report will provide the basis for his program during a longer
it to Curaçao later this year.

Denmark. The International Training Center for Fishery Administrators opened in Copenhagen on 29 August and will close on October. Some 20 participants from Aden, Ethiopia, Egypt, Gold Coast of Africa, Iran, Israel, Italy, Jordan, Malta, Nigeria (East and West), Somalia (Italian) and Somaliland (British), Sudan, Turkey, East Africa High Commission (Lake Victoria), Uganda and Yugoslavia were selected to attend this Center where courses and lectures are being given by 6 officers from FAO Fisheries Division and 15 fisheries officers from Denmark, together with 4 lecturers respectively from the Netherlands, Norway, Sweden and the U.K.

Ecuador. Karsten Hoydal (Denmark/Faroes), fishery technologist, has carried out further demonstrations in salting and drying at Manta, but the fish meal plant is not yet in operation since it still lacks connection to a source of electric power. Mr. Hoydal has also been continuing his advisory work on fish refrigeration.

D. Quiroga Rios (Spain), fishery economist, assumed duty in Ecuador on 11 July, after briefing in Rome and at the FAO Regional Office in Santiago, Chile. The main object of his mission will be to assist in planning and putting into effect a comprehensive project for marketing, processing and distributing fish landed in the Manta area.

C. J. Mignone has been awarded a fellowship in fishery technology and is carrying out a training program based at the Atlantic Fisheries Experimental Station of the Canadian Government at Halifax, N. S. A fellowship has also been awarded in fisheries economics to Gonzalo Pitzmann; an important part of his training will be given at FAO Headquarters in Rome, and this will be followed by field studies in Italy, Portugal and Spain.

Egypt. The program of K. W. Jensen (Norway), inland fishery biologist, and his Egyptian co-workers at the seaplane base near Alexandria (hydrodrome) has been continued, although with some interruption in the continuity of certain of the record sheets due to transfer of local scientific personnel to other work in Egypt. It is hoped, however, to continue this series of observations in its entirety throughout 1956.

A fishery statistician is also being recruited to design improved systems for the collection of fisheries statistics and, where necessary, to organize sampling surveys.

Finland. A water pollution consultant is being recruited to advise on the control of industrial pollution in natural fresh waters for the protection of fish life.

Guatemala and *Honduras.* S. Y. Lin (China), inland fishery biologist, is on home leave and returned to duty in September.

Haiti. Martin Routh (U. K.), fishery engineer, is engaged on a reconnaissance survey of the existing marine fisheries and has already

covered more than half the coastline of Haiti. When a small fishi craft is delivered for his use by FAO, he will be able to begin program of experimental fishing with the help of local craftsmen.

India. P. Ziener (Norway), naval architect, is continuing t develop his program in the States of Orissa, Madras, West Bengal an Andhra. He is studying the problem of introducing surf landin craft in Orissa, and preparing designs for fish carrier vessels in the Sun derbans area of West Bengal. Meanwhile, FAO has undertaken t build three surf boats to Mr. Ziener's designs and a contract has bee placed in Cochin. It is hoped to carry out sea-going and surf-pass ing trials with these vessels in October off the Coromandel coast in the presence of J-O. Traung, naval architect, from Headquarters Mr. Ziener and Mr. G. Illugason.

G. Illugason (Iceland), fishery engineer, is working down the Coromandel east coast in the Japanese-built Pacific coast type seine *Samudra*, which was furnished to the Government of India under the U.S. Point IV Program (ICA). He is carrying out experimental fishing at various places and demonstrating to fishing communities the methods he has already found successful including nylon gill nets and shrimp trawls. On this voyage he proposes to turn the southern point of the Indian continent and work up the Malabar (west) coast towards Tellicherry. Meanwhile, fishermen trained by Mr. Illugason have been independently operating an FAO-owned 22-ft. Danish boat, with earnings over operating costs well above previous unaided experience; many enquiries have been received from fishermen interested in acquiring such craft, and this matter is receiving the attention of the Madras Government. Even fishermen, using nylon gill nets, introduced by Mr. Illugason to the craft catamarans. have been able substantially to increase their earnings.

Pierre Lusyne (Belgium), fisheries training specialist, began his mission by studying fishing conditions right round the Maritime States with a view to planning courses of instruction and organizing a training school for progressive fishermen at Satpati, Bombay ; he visited Bombay, Madras, Andhra, Orissa and Bengal. The first training school was inaugurated at Satpati on 9 August 1955.

The following additional appointments are in progress : C. R. Bjuke and C. G. Bjuke (Sweden), fish harbor specialists to assume duty in September, a naval architect, a fishery technologist, a fishery engineer (for Saurashtra), a fish marketing specialist, an inland fishery biologist (for Orissa), and a fishing fleet manager for Bombay.

Indonesia. The International Training Center in Inland Fisheries and Fish Culture will open at Bogor on 31 October 1955. The following appointments have been made by FAO : Director, Mr. Hasanoedin Saanin (Indonesia) ; Associate Director, W. H. Schuster (Netherlands) ; lecturers : P. Chimits of FAO Headquarters, Dr. Wylie Goodsell (U.S.A.) ; M. Huet (Belgium) ; D. G. Frey (U.S.A.) ; the Indonesian Government will also supply 4 or 5 lecturers. All available places at this Center have been filled.

Iran. H. Fibiger (Denmark), fishery engineer, is concentrating his erimental fishing during the monsoon season in the waters of the uth of the Persian Gulf within reach of the fish cannery at Bandar bas, especially shrimp trawling and a study of the reaction of line-type fish to lampara lamps at night.

Iraq. A. van den Eelaart (Netherlands), inland fishery biologist, r a further review of the inland fisheries, has recommended the rgement of the extension branch of the Iraqi Fisheries Department, the creation of an inland fisheries research station where applied earch can be undertaken. He has also carried out further obser- ions in preparation for the arrival of H. A. Lynch (Canada), a l engineer, who will advise on the construction of passes to enable fi to go over or around dams.

Israel. M. Erlich has resumed the fellowship which was errupted earlier this year, and is completing his studies on distant ter trawling in Portugal, Spain and French West Africa. R. Rupin s concluded his FAO/ETAP fellowship. He studied the organization l curricula of training schools for fishermen, spending over two nths in the U. K. and visiting fisheries schools in the Netherlands l Norway. A fellowship has also been awarded to B. Kagan in canning technology and he will commence his studies in western rope later this year.

Liberia. Knud Frederiksen (Denmark), fishery engineer, has cluded his program of work in Liberia and is preparing his final port at Headquarters.

Libya. A fishery specialist is being recruited to undertake the posed reconnaissance survey of fishery conditions.

Mexico. J. Fridthjof (Denmark), fishery economist, concluded s fish consumption promotion work in August. He is endeavor- g to ensure that the programs he has launched will be effectively llowed up and continued after his departure. In particular the lot project for the promotion of increased fish consumption in the ate of Morelos will be made permanent and extended to cover the hole state. Similar pilot projects are functioning in the States Mexico and Veracruz. On his return to Rome he will prepare a hal report on his mission. A fishery economist will be appointed ter in 1955 to carry out a general economic survey of the fishery dustry.

Panama. M. Burkenroad (U.S.A.), shrimp biologist, with his anamanian co-workers, is concentrating field work on problems of evelopment and growth of the economically important species of rimp, particularly on young shrimp in the lagoons. Very high owth rates are indicated in these young stages, using novel examin- ion techniques developed by Mr. Burkenroad himself.

Dr. S. A. Beatty (Canada), fishery technologist, stopped over in anama for three or four days en route to Brazil to investigate the ossibilities of developing a fish meal industry in Panama. His con- usions, in which he suggested a more economical way of preserving

trash fish caught incidentally during shrimp trawling, indicate th fish meal production may be profitable.

Paraguay. Dr. Otto Schubart (Brazil) was unable to unde take the general survey of the inland fishery resources in Paragua and recruitment is again in progress to fill this post.

Saudi Arabia. G. Ferrer (Philippines), fishery engineer, h advised on the construction of an 80-ft. fishing vessel which t Saudi Fishing Co. is having built in Egypt. Meanwhile, he is continui experimental fishing to two 22-ft. local craft, especially with botto set gill nets, trolling, and experiments on fish behavior with lights a prelude to the introduction of lift nets with the new vessel wh it is completed.

Syria. Dr. Wm. C. Beckman (U.S.A.), inland fishery biologis assumed duty in Damascus in July. His principal task will be t develop a plan for utilizing and developing the inland fisheries resourc of the country and initially he is carrying out a general survey the present situation. Concurrently, he will carry out a reconnaissan of the marine fisheries of Syria, and the assignment of a special expe to undertake marine experimental fishing has been deferred.

Turkey. Olav Aasen (Norway), marine fishery biologist, whi on home leave, made arrangements in Norway and Denmark for program of studies for a Turkish fellowship holder in the field marine fishery research.

J. Einarsson (Iceland), fishery engineer, has been carrying out program of experimental fishing for pelagic fish in the Sea of Marmara especially with the use of lights at night. R. Gudmundsson (Iceland) fishery engineer, has carried out experimental work on ground fis in the Iskenderun area, comparing the performance of various design of trawl; the catch is being subjected to statistical analysis by Turkis fishery biologists.

Dr. A. A. Dawson (U.K.), fish marketing specialist, has transferre his duty station from Ankara to Istanbul, where he is advising on th establishment, layout and organization of a new fish market. Dr. G. S Meseck (G many), later this autumn will make a short survey of th general policies with regard to fisheries and the planning of organiz- ational measures to implement these policies. In the spring of 1956 he will probably continue his survey during another short assignment. Recruitment is in progress for a naval architect.

Yugoslavia. P. Chimits, inland fishery biologist at Headquarters visited Yugoslavia to discuss the terms of reference of the inland fishery post for which recruitment is now in progress.

A fellowship has been awarded F. P. Grubisič to study modern trawling methods ; after preliminary studies in Italy, Mr. Grubisič mov- ed to Denmark. I. J. Tilič, under an FAO fellowship, is studying in the general field of fisheries economics, and during a visit to Den- mark made a special study of fisheries organizations and institutions in that country ; he then undertook similar studies in the Netherlands and was especially interested in the functions and operation of the Fish Marke- ting Board there. Mr. Tilič will complete his studies in Western Germany.

INDEX TO FAO FISHERIES BULLETIN, VOL. VIII

nton Dohrn, The New German Fishery Research Vessel. (2), frontispiece.

onferences and Meetings. (1), 36-50 ; (2), 85-94 ; (3), 142-51 ; (4), Calendar, (1), 36 ; Revisions, (3), 151.

Association of Physical Oceanography. (2), 85-89.

Biometrics Society Symposium. (1), 36.

Caribbean Fisheries Seminar. (3), 151.

Commonwealth Oceanographic Conference. (1), 46-47.

Economic and Social Council. 19th and 20th Sessions (1), 36.

Economic Commission for Asia and the Far East, 11th Session. (1), 36.

Economic Commission for Europe. (1), 36.

Economic Commission for Latin America. (1), 36.

FAO Conference. 7th. (2), 97; 8th, (1), 36.

FAO Consultants' Meeting on Documentation and Related Services for Fisheries Biology. (1), 91-94.

FAO Fisheries Technology Meeting. (1), 36 ; (3), 158.

FAO International Congress on Fishing Gear and Methods. (1), 36 ; (3), 156-57.

FAO Regional Consultation on the Selective Expansion of Agricultural Production and Consumption. (3), 151.

FAO Regional Meeting on Food and Agricultural Programs and Outlook in Latin America, 3rd. (1), 37-38.

General Fisheries Council for the Mediterranean. 3rd, (1), 41-45 ; (2), 96 ; 4th, (1), 36.

Gulf and Caribbean Fisheries Institute, 7th Session. (2), 94 ; 8th, (3), 151.

Indian Science Congress. (1), 36.

Indo-Pacific Fisheries Council. 6th, (1), 36 ; (2), 96.

Inter-American Statistical Conference, 3rd. (1), 36.

International Advisory Committee on Marine Sciences, meeting of experts to consider the terms of reference and mode of operation, (3), 142-44 ; meeting of Interim Committee (3), 151 ; Symposium on Physical Oceanography. (3), 151.

International Canning Congress. 3rd, (1), 36.

International Commission for the North Pacific Fisheries, 5th, (1), 36.

International Commission for the Northwest Atlantic Fisheries, 5th meeting, (1), 36 ; (3), 148-50 ; 6th, (3), 150, 151 ; Committee on Research and Statistics. (3), 150, 151.

International Commission for the Scientific Exploration of the Mediterranean Sea. (1), 45.

International Conference on Marine Biological Laboratories. (1), 36 ; (3), 146-47.

International Congress of Biochemistry, 3rd. (1), 36.

International Congress on Refrigeration. 9th. (1), 36.

International Council for the Exploration of the Sea. (1), 36, 45-46.

International Council of Scientific Unions. (1), 36.

International Labour Office, 127th session of the Governing Body. (1), 50.

International Organization for Standardization. (1), 36.

International Permanent Committee on Canned Foods, 1954 Session. (1), 48-50 ; (3), 151.

International Rice Commission, 4th session. (1), 39-41.

International Seaweed Symposium, 2nd. (1), 36 ; (4), 223-24.

International Union of Biological Sciences, 12th General Assembly. (1), 36 ; (3), 144-46.

International Union of Geodesy and Geophysics, 10th General Assembly. (2), 85-91 ; Association of Physical Oceanography (2), 85-89 ; International Geophysical Year, (2), 89-91 ; 11th, (1), 36.

International Union of Pure and Applied Chemistry. (1), 36.

International Whaling Commission, 7th Annual Meeting. (1), 36 ; (4), 221-23.

Latin American Fisheries Council. (2), 96.

Limnological Congress, 13th. (3), 151.

Marine Biology, meeting of experts organized by the Center for Scientific Co-operation in Latin America of UNESCO, and by FAO. (1), 48.

Pan-American Institute of Geography and History, 6th General Assembly. (3), 151.

Permanent Commission of the International Fisheries Convention 1946. 4th meeting (1), 36.

Selective Expansion of Production and Consumption in the Near East. (1), 38-39.

South Pacific Commission, 7th Meeting of Research Council. (3), 151.

Symposium on Geographical Factors in the Development of Tropical Africa. (1), 36.

Symposium on Man's Role in Changing the Face of the Earth. (3), 150-51.

Symposium on Physical Oceanography. (3), 152.

UN Statistical Commission. (1), 36.

UN Technical Conference on the Conservation of the Living Resources of the Sea, (3), 117-29.
UNESCO, Latin American Marine Biological Laboratories, and Symposium on Plankton. (3), 151.
UNESCO, Meeting of representatives of marine science institutes in the Indo-Pacific region. (3), 151.
World Meteorological Conference, 2nd. (1), 36.

Contribution of Oceanographic Research to Fisheries Science, The. (2), 67-76.

Current Fisheries Literature

Selected Publications and Books Received

British Fisheries Directory and Buyers Guide. (2), 114.
Chesapeake Bay Crab Industry, The. (2), 113.
Circumpolar Continuity of Antarctic Plankton Species, The. (2), 111.
Descriptive Study of Certain Tuna-Like Fishes, A. (2), 112.
Dispersal in Blue and Fin Whales. (2), 112.
Estudio elemental de la pesca y sus problemas [Elementary Study of Fishing and its Problems]. (2), 114.
Factors Influencing the Orientation of Migrating Anadromous Fishes. (2), 114.
Fishes of Ceylon. A Catalogue, Key and Bibliography. (2), 114.
Food and Agricultural Legislation, Vol. III, No. 2. (2), 111.
Food of the Whiting and a Comparison with that of the Haddock, The. (2), 112.
Handbuch der Werften [The Shipyard's Handbook] 1954. (2), 112.
Indexes of Transportation Rates for Fishery Products. (2), 113.
Indian Journal of Fisheries, Vol. 1, No. 1/2. (1), 65-66.
Investigaciones zoolcgicas chilenas, Vol. 2, No. 2. (2), 113.
Notes on the Use of Theoretical Models in the Study of the Dynamics of Exploited Fish Populations. (2), 114.
Open Boat Whaling in the Azores. The History and Present Methods of a Relic Industry. (2), 114.
Pelagic Mollusca of the Benguela Current, The, Part I. (2), 111.
Production of Fish in the Colonial Empire. (2), 113.
Study of Populations of the Anchoveta, *Cetengraulis mysticetus*, based on Meristic Characters. (2), 114.
Toxic Effects of Sulphite Waste Liquor on Young Salmon. (2), 114.
Western End of Lake Erie and its Ecology, The. (2), 112.

Journals and Periodicals

Bamidgeh. (2), 114-115.
Boletin del Instituto Español de Oceanografia. (2), 115.
Journal of the Marine Biological Association of the United Kingdom. (2), 11

Administrative Reports

Canada. Fisheries Research Board of Canada Annual Report 1953. (2), 115.
France. Annuaire de la marée et de l'armement à la pêche [Fishing Industry and Fish Trade Yearbook]. (2), 115.
India, Government of Travancore-Cochin Administration Report of the Fisheries Department for the Year 1952/53. (2) 116.
International Commission for the Northwest Atlantic Fisheries, Annual Proceedings for the Year 1953/54. (2), 116.
International Commission on Whaling, 5th Report of the Commission, 1953/54. (2) 116.
International Labour Organisation, Committee of Experts on Conditions of Work of Fishermen, Reports. (2), 116.
Ireland, Report on the Sea and Inland Fisheries for the Year 1953, incorporating statistics of the capture of salmon, sea trout and eels. (2), 116.
Scotland, Scottish Marine Biological Association, Annual Report 1953/54. (2), 116.
Union of South Africa, Department of Commerce and Industries, Division of Fisheries, 24th Annual Report 1952/53. (2), 116.
U.S.A. Corps of Engineers, U.S. Army. Annual Report, Passage of Fish Over Bonneville Dam, Columbia River, Oregon and Washington. (2), 116.
U.S.A. University of Miami Marine Laboratory. Proceedings of the Gulf and Caribbean Fisheries Institute, 6th Annual Session. (2), 116.
U.S.A. Washington Department of Fisheries. 63rd Annual Report, Year 1953. (2), 116.

FAO/ETAP International Training Centers in Fisheries. (4), 202-21.

FAO Plans for a World Survey of Living Aquatic Resources. (2), 94; (3), 150; (4), 197-202.

Fisheries and Naval Architecture. (4), 167-97.

Fisheries Division Activities. (1), 51-64; (2), 95-110; (3), 152-66; (4), 224-34.
Aquatic Resources Survey, (2), 94, 97-98; (4), 197-202.
Bibliographic Program, fisheries biology, (2), 91-94; 96-97.

Budget. (1), 53-54.
Economics, (4), 226-228.
Expanded Technical Assistance Program. (1), 53-54, 54-64 ; (2), 97, 103-10 ; (3), 154-55, 159-66 ; (4), 229-34.
Brazil. (1), 54 ; (2), 103-4 ; (3), 159-60 ; (4), 229.
Burma. (1), 54 ; (2), 104 ; (3), 160 ; (4), 229.
Caribbean Commission. (3), 160.
Ceylon. (2), 104 ; (3), 160 ; (4), 230.
Chile. (1), 55 ; (2), 104-5 ; (3), 161 ; (4), 230.
Colombia. (1), 55 ; (2), 105 ; (3), 161 ; (4), 230.
Costa Rica. (1), 56 ; (2), 105 ; (3), 161 ; (4), 230.
Curação (Netherlands Antilles). (1) 56 ; (2), 105 ; (3), 161 ; (4), 230-31.
Denmark. (1), 56 ; (2), 105 ; (3), 161 ; (4), 231.
Dominican Republic. (1), 56 ; (2), 105.
Ecuador. (1), 56-57 ; (2), 105 ; (3), 161-62 ; (4), 231.
Egypt. (1), 57 ; (2), 106 ; (3), 162 ; (4), 231.
Finland. (1), 57 ; (2), 106 ; (3), 162 ; (4), 231.
Guatemala. (1), 57 ; (2), 106 ; (3), 162 ; (4), 231.
Haiti. (1), 57-58 ; (2), 106 ; (3), 162 ; (4), 231-32.
Honduras. (1), 58 ; (2), 106 ; (3), 162 ; (4), 231.
Hong Kong. (1), 58 ; (2), 106.
India. (1), 58-59 ; (2), 106-7 ; (3), 162-63 ; (4), 232.
Indonesia. (1), 59 ; (2), 107 ; (3), 163 ; (4), 232.
Iran. (1), 59 ; (2), 107 ; (3), 164 ; (4), 233.
Iraq. (1), 59 ; (2), 107 ; (3), 164 ; (4), 233.
Israel. (1), 59-60 ; (2), 107-8 ; (3), 164 ; (4), 233.
Jamaica. (1), 60.
Liberia. (1), 60 ; (2), 108 ; (3), 164 ; (4), 233.
Libya. (1), 60 ; (2), 108 ; (3), 164 ; (4), 233.
Mexico. (1), 60-61 ; (2), 108 ; (3), 164 ; (4), 233.
Pakistan. (1), 61.
Panama. (1), 61 ; (2), 108 ; (3), 165 ; (4), 233-34.
Paraguay. (1), 61 ; (2), 108 ; (3), 165 ; (4), 234.
Saudi Arabia. (1), 61 ; (2), 109 ; (3), 165 (4), 234.
Somalia. (2), 109.
Syria. (1), 61 ; (2), 109 ; (3), 165 ; (4), 234.
Thailand. (1), 61-62 ; (2), 109.
Turkey. (1), 62 ; (2), 109-10 ; (3), 165-66 ; (4), 234.
Yugoslavia. (1), 62-63 ; (2), 110 ; (3), 166 ; (4), 234.
Equipment, ETAP Program, 1955. (1), 63.
ETAP Reports Issued (Fisheries). (1), 63-64.
FAO/ETAP Training Centers, see **Training Centers.**
Program for 1955, Category I. and II. (1), 63.
FAO Interim Committee on Fishing Handling and Processing, (3), 157.
Fish Handling and Processing. (3), 156-57.
Latin American Fisheries Training Center, 2nd. (2), 98-101.
Personnel. (3), 159 ; (4), 228.
Program of Work - Fisheries Division. (1), 51-54 ; Biology Branch, (2), 95-98 ; Technology Branch, (3), 152-57 ; Economics and Statistics Branch, (4), 224-28.
Publications
Commodity Standards for Fisheries Products. (3), 156-57.
Dictionaries for fisheries technological terms. (3), 152-53.
FAO Catalogue of Fishing Boat Tank Tests. (3), 154.
FAO Fisheries Papers. (3), 158-59.
FAO Yearbook of Fishery Statistics, Part I, 1952-53. (2), 102-103.
Films. (3), 153.
Fishing Boats of the World. (3), 154, 158-59.
General Fisheries Council for the Mediterranean, *Proceedings and Technical Papers* No. 3. (3), 159.
Handbook on Fishing Gear and Methods. (3), 155.
World Fisheries Abstracts. (3), 152, 153, 155, 156.
Statistics. See Program of Work.
Hydrobiological Research Council established in Peru. (3), 141.
International Geophisical Year. (2), 89-91
Note to Readers. (1), 33.
Operation "Merluza". (1), 34-35.
Report on the United Nations Technical Conference on the Conservation of the Living Resources of the Sea. (1), 36 ; (3), 117-29.
Smal Boat and Gear Insurance for Canadian Fishermen. (2), 77-85.
Some Simple Oceanographical Instruments to Aid in Certain Forms of Commercial Fishing and in Various Problems of Fisheries Research. (3), 130-41.
Tilapia and its Culture, a Preliminary Bibliography. (1), 1-33.
Training Centers, FAO/ETAP, (1), 36 ; (3), 152 ; (4), 202-21
Hong Kong International Fish Marketing Training Center. (1), 58 ; (2), 106 ; (4), 202-21.

Training Centers *(continued)*
Indo-Pacific Brackish Water Fish Culture Seminar, Indonesia. (4), 202-21.
Indo-Pacific Fisheries Statistics Training Center, Thailand. (4), 220-21.
International Training Center for Fishery Administrators, Denmark. (1), 36, 56; (2), 105; (3), 161; (4), 202-21.
International Training Center in Fish Culture, Indonesia. (1), 36, 59 ; (2) 107 ; (3), 163 ; (4), 202-21.
International Training Center in Fishery Biology, Turkey. (4), 202-21,
Latin American Fisheries Training Center, 1st. (1), 60 ; (4), 202-21, 2nd, (2), 98-101 ;

ARTICLES

Contribution of Oceanographic Research to Fisheries Science, by G.L. Kesteven, and G.E.R. Deacon, (2), 67-76, bibl.
FAO/ETAP International Training Centers in Fisheries, by C. Beever. (4), 202-21.
FAO Plans for a World Survey of L ing Aquatic Resources, by G.L. Kes ven. (4), 197-202.
Fisheries and Naval Architecture, J-O. Traung. (4), 167-97. bibl.
10th General Assembly of the Interr tional Union of Geodesy and Ge physics, Rome, 14-25 September 19 by G.E.R. Deacon. (2), 85-91.
Operation "Merluza" (1), 34-35.
Report on the United Nations Technic Conference on the Conservation eth Living Resources of the Sea, (117-29.
Small Boat and Gear Insurance f Canadian Fishermen. (2), 77-85.
Some Simple Oceanographical Instr ments to aids in certain Forms of Co mercial Fishing and in various Pro lems of Fisheries Research, by J.M Carruthers, collaborator A.J. Woods, (3 130-41.
Tilapia and its Culture, a Preliminar Bibliography, by P. Chimits. (1), 1-3 bibl.